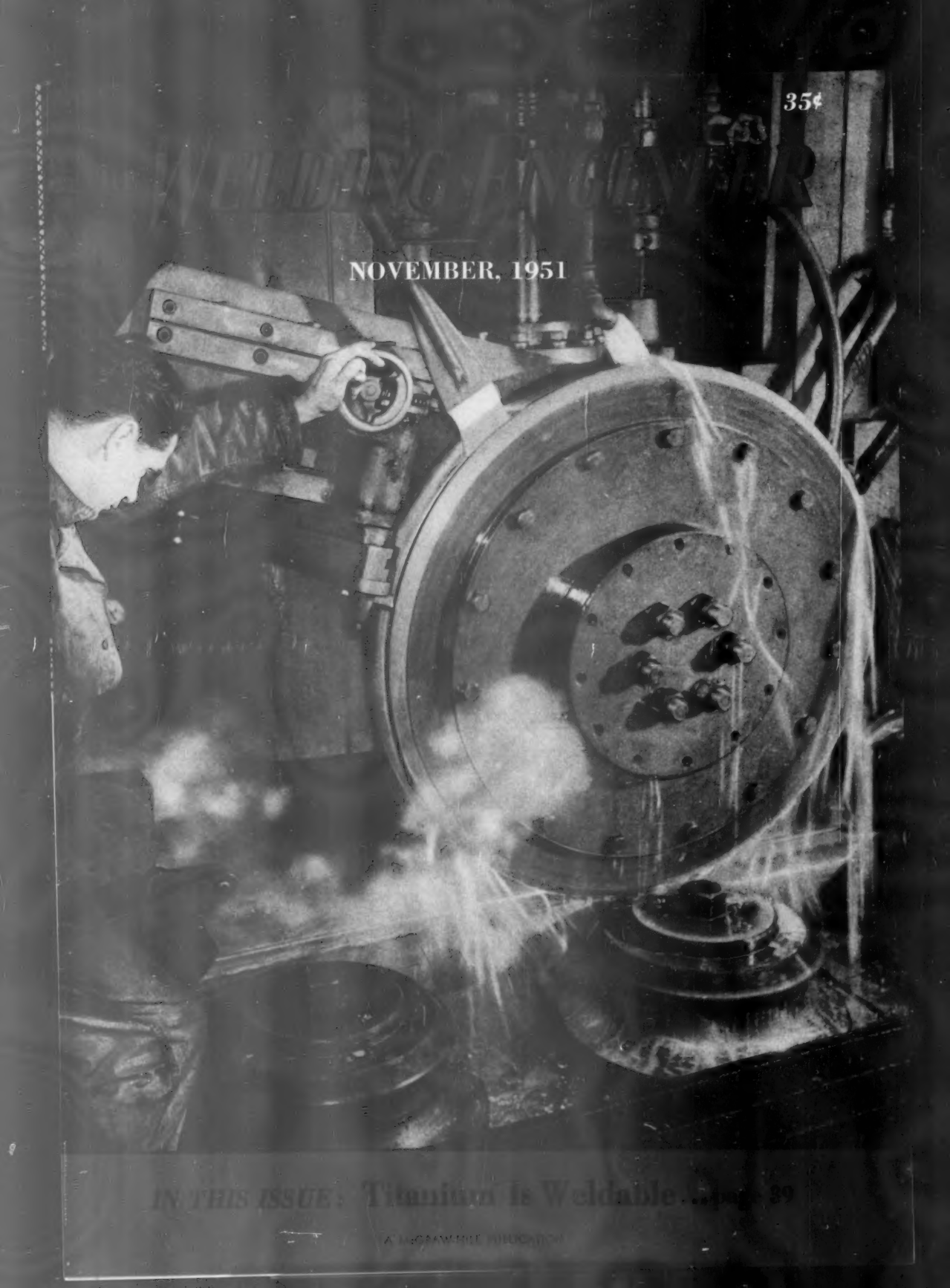
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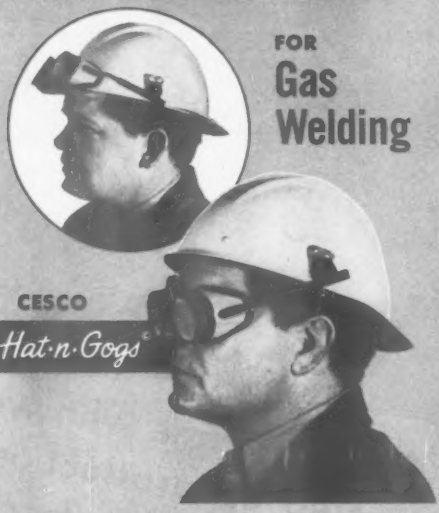

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NOVEMBER, 1951

COVER: *Top edge of piping is seam welded as it passes through the Kaiser Steel Corporation's continuous pipe mill at Fontana, Calif.* *See page 48.*

PRODUCTION

New Wrinkles in Heat Exchangers 33
Clyde B. Clason

Straight-Line Production of Pipe 48

Faster Production by Stud Welding 51

CONSTRUCTION

All-Welded Framework in New Department Store 36
Fred M. Burt

RESEARCH

Titanium Is Weldable 39
Thomas A. Dickinson

Welding Ductile Iron 45
W. C. Mearns

Ways to Weld Magnesium Alloys 52
R. L. Nelson and I. C. Mattson

FABRICATION

Microwave 42
Sam Kaplan

MAINTENANCE

Thermit Helps Texas Drilling 58
Jack I. Medoff

DEPARTMENTS

News from Washington 5

Editorial: Still Missing the Boat 31

New Products for Welding 62

Engineering Data Sheet No. 134 65

For Your Technical Library 67

On the Job 70

News 72

About People 86

30 Years Ago 89

From the Patent Office 95

Where to Buy 99

Searchlight Section 99

Advertisers in This Issue 100

COPPER ALLOY HOLDERS

Jackson's basic design, all purpose holders are the only 98% copper alloy holders heat treated for greater strength, hardness, conductivity.

New Double-A models have lower jaws replaceable at a fraction of the cost of the entire lower tong.

AA-1 takes electrodes through ¼" AA-3 and AA-3S through ⅜." AA-3S has larger handle for cooler operation.

Old favorites A-1, A-3, A-3S, with one-piece tongs (and same capacities) are being continued.

JACKSON

STREAMLINED HOLDERS

They are made to work in places hard to get at, and may be passed through narrow openings.

They are more completely insulated than other Jackson holders, yet there is no fumbling to drop a stub, or insert a new rod, due to their tong type construction.

Made of light metal alloy, they have all the advantages of Jackson's Featherlight holders, within their rated capacities. Model JH-2, electrodes through 5/32", model JH-3, through ¼".

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Hands do not tire as quickly, when Featherlight holders are used. Made of lightweight alloy, they weigh 36% less than copper alloy holders of the same capacity.

Model A-W takes ¼" electrodes, model A-5S takes them through 5/16". Both give excellent service within their rated capacities, and many weldors use them for all purposes.

On these holders cables must be clamped mechanically.

BLADE TYPE HOLDERS

Many weldors like the simplicity of holders with blades of spring steel, easily and inexpensively replaced.

They will prefer Jackson's BT holders for their smooth outlines and crown type insulators.

INSULATORS. Jaw insulators on these and all other Jackson insulated holders are of laminated fiberglass with melamine binder. They are exceptionally strong, and effectively withstand the greater duty cycles called for today.

GOGGLES and

The little gas weldor at the right points with pride to his headrest goggles. They're Jackson's type W-50, a quality product designed for safety and comfort. Although, at 8 ounces, they are the lightest of their kind on the market, they give maximum protection for gas welding, cutting, brazing.

Type G-50, with clear, hardened lenses, is used for chipping and grinding. Both types are light and easy to wear, simple

EYESHIELDS

and easy to adjust, practical and easy to raise and lower.

Other Jackson products include headrest eyeshields and spectacles for gas welding, cutting and brazing, and type J-1, an eye and face shield in clear plastic as well as in shades of green, that has found many uses in various industries.

All Jackson products sold only through distributors and dealers near you.

JACKSON PRODUCTS — **WARREN • MICHIGAN**

NEWS FROM WASHINGTON

Small Steel Users To Get Their Share

RESTORATION of 1950 steel usage levels to warehouse distributors, announced recently by NPA, is said to "assure a continuing flow of iron and steel products to thousands of small users who traditionally order supplies in less than mill quantities."

After the beginning of the new year, mills will be required to ship to warehouse distributors 100% of the January through September, 1950, steel usage instead of the 85% currently required.

This NPA order follows a recent cutback in the military's allocation of stainless steel, resulting from the fact that its original requirements had been overestimated. It is believed that defense requirements of carbon steel will also be subjected to close scrutiny, in the hope that additional amounts may be made available to makers of civilan goods. While the addition to the civilian supply of stainless steel from the military's surplus amounted to 7% of total stainless production, the prospects of uncovering comparable surpluses in carbon are not so promising.

Cost Adjustment for Machinery Materials

EFFECTIVE October 13, OPS modified the method by which machinery manufacturers figure out adjustments for material costs in determining their price ceilings under CPR 30.

Hereafter they can figure adjustments on only those materials that make up 75% of the total cost of materials instead of the full 100% they have been allowed previously. However, any material item that is more than 3% of the total materials cost must be included in figuring the adjustment.

New Pricing Formula Due for Construction

A NEW PRICING formula for the construction industry has been drawn up by OPS and is said to be due for issue early in November. Prime and subcontractors will be allowed to figure their price ceilings by adding 100% of their base period percentage mark-up to overhead costs, but only 90% of the base mark-up to labor and material costs. Ceiling control is to be on a percentage margin, rather than on dollars.

NPA Exempts Import Steel from Quotas

U. S. MANUFACTURERS who use foreign steel need no longer deduct the tonnage they import from their steel allotment under the Controlled Materials Plan, even though they take title to the steel only after it reaches this country. This is the result of NPA's amendment to Direction 4 of CMP Regulation 1, which was recently put into effect.

Under the old system, imported steel tonnage had to be deducted from the manufacturer's regular allotment when the steel was bought after it reached the U. S.; it could be used as a supplement to his quota only if it were actually bought abroad. Now, in effect, all imported steel shapes and forms in the controlled materials list are "gravy," so far as allotments are concerned.

Aluminum and copper controlled materials imported from abroad have not been similarly exempted.

Power Unit Production Needs No NPA Approval

A LIBERALIZING amendment to NPA Order M-44 exempts builders of power and electric equipment from the need for seeking specific approval for the production of their units. The aim, according to NPA spokesmen, is to achieve "maximum production with a minimum of direction," and to reduce paper work. New orders may not interfere with promised delivery dates of existing approved orders, however, NPA points out.

The new order does not free manufacturers of the requirement to file production schedules with NPA. All those who have not been specifically exempted by the agency are required to file such schedules. Exemptions may be granted if orders are not related to national defense, if they form a relatively small part of the total plant output, if they are not needed in vital projects, or if it is clear that satisfactory delivery can be expected.

Steel Speed-up Set for First Quarter

A SUBSTANTIAL expansion in the nation's steel capacity can be expected in 1952. Agreements between Defense Mobilizer Charles E. Wilson, Defense Production Administrator Manley Fleischmann and the heads of 24 major steel companies provide for channeling as much equipment and material as possible into new capacity, starting next year. Though there has been no firm commitment as to the degree of expansion to be allowed, it seems clear that the next quarter will bring an improvement over the present one, during which the allocation of structural steel for new capacity was held to 51% of the industry's requests.

There are two further stumbling blocks in the expansion program: (1) the critical shortage of scrap and (2) military demand for difficult types of product and melt, such as the high-alloy steels used in jet engines.

Priority in the expansion program is to be given to coke ovens, blast furnaces and other basic elements needed to alleviate the shortage.

Conversion Steel Users Allowed Price Boost

MANUFACTURERS who make use of conversion steel (that is, steel bought by the manufacturer in some basic form and then processed by another company to a form he can use) may now figure the higher cost of this material into their ceiling prices, OPS has ruled. Cost increases of up to 200% of the cur-

NEWS FROM WASHINGTON *(Continued from page 5)*

rent mill price of the same type of steel may now be used in figuring prices under CPR 22 and 30.

The move is a result of NPA's attempt to increase production by the increased use of conversion steel. Ordinarily, this is an unsatisfactory procedure. It means, for example, that the manufacturer who uses sheet steel in his process buys billets and has a rolling mill process them into sheets for him. This in turn means extra processing costs, and extra transportation costs as well; however, it may be the only way to get the steel at all, in present tight markets.

Before the added conversion costs can be figured in ceiling prices, manufacturers seeking increases must file a detailed report with OPS. Conversion steel cost increases must be recomputed every three months, under the Order.

Ceiling Prices for New Manufacturers

THOSE who have gone into business since January 1, 1951, and who cannot, therefore, determine ceiling prices under the machinery ceiling price regulation (CPR 30), may now apply for OPS approval of proposed ceilings. Applications for either specific ceilings or a price determining method should be made on OPS Public Form 90 or 91, and sent by registered mail to the Office of Price Stabilization in Washington.

Pending receipt of approval by OPS for the ceilings he has submitted, the seller is permitted to quote the proposed ceilings to customers, but he may not accept payment for more than 75% of the price quoted until after the ceiling has been approved. If no action has been taken by OPS within 30 days of their receipt of the application, the proposed ceiling may be considered as approved, except that OPS reserves the right to disapprove such a ceiling later.

A seller who has established ceiling prices under the General Ceiling Price Regulation may continue to use such ceilings until his application has been acted upon.

Tank IAC Approves New Product Listings

HEAVY METAL Tanks Industry Advisory Committee has endorsed NPA's proposed revision of the Class "A" and "B" products lists. The new listings will clarify the status of a large variety of tanks, ranging from home water storage tanks to the large storage tanks used by the chemical and petroleum industries.

"B" products, according to the new definitions, will include those tanks and vessels which are produced by a regular fabricator or manufacturer and are normally constructed to conform to the manufacturers design and sold in accordance with a published price list. Allocations of controlled materials to "B" products are made by NPA.

"A" products are those made to the customers' orders, as well as specified exceptions to the "B" class. For these, claimant agencies would make the allotments of steel sheet and plate.

NPA Aides Seek to Seize Steel Scrap

SO ACUTE is the shortage of scrap that government officials are despairing of getting the anticipated increase in steel production. In order to supply the steel industry with the so-badly-needed scrap, NPA aides are seeking the authority to seize and confiscate privately owned scrap iron and steel for shipment to the mills. NPA officials, however, emphatically deny any attempt to requisition supplies from private dealers.

If successful, the seizure action would start with the mining industry. Large amounts of obsolete mining machinery are piled up below the earth's surface and have not been worth raising prior to the present shortage.

By contrast, the automobile industry has been voluntarily gathering up scrap in appreciable quantities ever since the reclamation drive got under way.

Machine Distributors Allowed Usual Mark-up

DISTRIBUTORS of machinery and related manufactured goods covered by CPR 67 will be unable to base their ceiling prices on the published list prices of any manufacturer who has changed his discount practices since January 24, 1950.

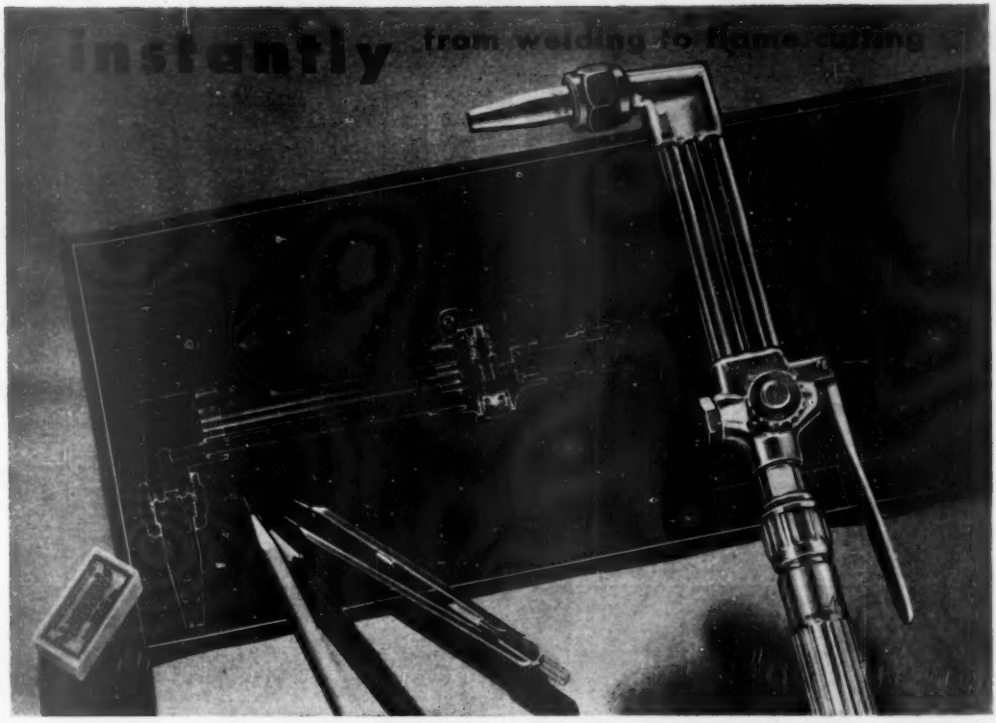
Under CPR 67, the distributor has been using the manufacturer's published list prices for establishing his own selling prices. The manufacturer usually sells to the distributor at fixed discounts off such list prices. However, some manufacturers had apparently altered their selling prices after June 24, 1950, by changing their discounts to distributors.

OPS has, therefore, amended the regulations by adding the new provisions for determining ceiling prices for such items. If the distributor finds he is unable to use the published list price as a result of a change in discount policy, he can determine his ceiling prices by adding the percentage mark-up he used in the April 1-June 24, 1950, period to his present cost.

Lead Shortage Facts Detailed

INFORMATION on the current lead situation, including details on supply and demand, the extent of the shortage, and some possibilities for the future, have been collected by DPA in a document titled the "Lead Fact Sheet" that tells where the lead goes and why. Despite the fact that world production this year is as great as last, the shortage has grown more acute. Lead users are reminded that the shortages are not caused by the allocations. Indeed, without an allocation system some users would get all the available lead, while others, including small users, would get very little or none at all, states this government bulletin.

Copies of the "Lead Fact Sheet" are available from NPA, Printing & Distribution Division, New GAO Building, Washington 25, D. C.



A cutting attachment can be a great nuisance or a wonderful helper to a busy welder . . .

Now, here is one you can depend upon to do the job swiftly, easily and fully dependably.

You can connect it onto your welding torch instantly—*without a wrench—just finger tightened*. No fuss, no loss of time or temper.

And—this leak proof joint stays gas tight—that's important to you too—*the patented neoprene sealing rings see to that*. This cutting attachment can take it.

We incorporated a high pressure valve which gives unrestricted flow to the oxygen and will not choke the preheating flames.

Never a burnt out "mixer" tube—because—no premixed gases flow through torch tubes—safety first.

We have made welding and flame cutting apparatus for a long time—*for over 40 years;* age, by itself, is no guarantee of wisdom, but here is a friendly challenge:

Try National after you are well satisfied with another make . . . . . .

Made by National SINCE 1910 WELDING EQUIPMENT CO., San Francisco 5, California

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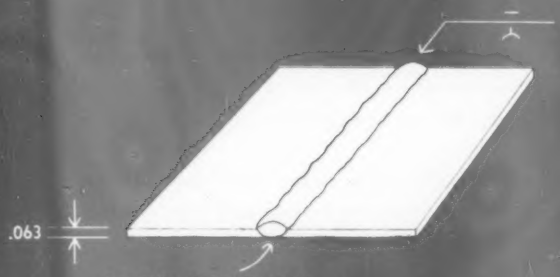

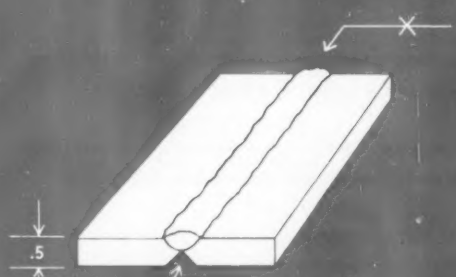

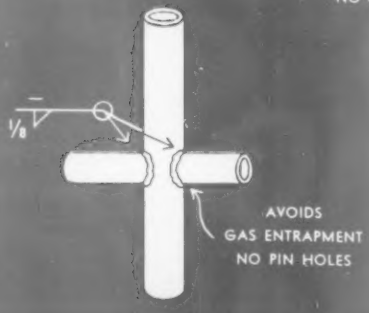

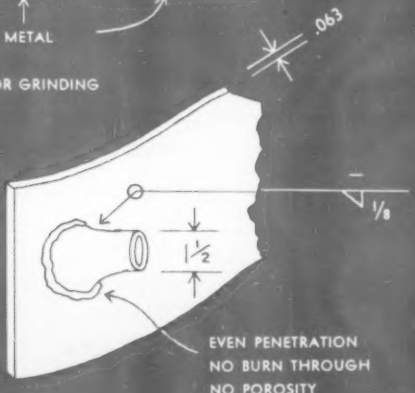

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(Please circle method to be used)

• ALLOY TO BE WELDED
(Please give AISI number or brand name)

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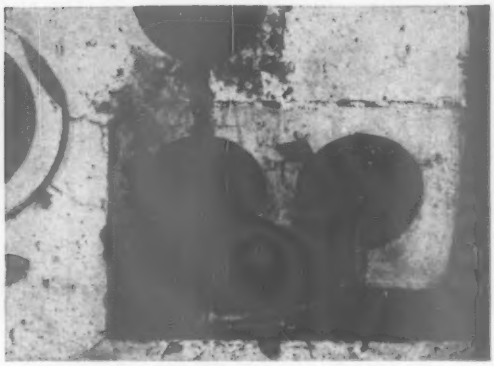
NAME _____ COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



BEFORE: This 5-ton gear case casting was shattered into 3 pieces.

AFTER: The same casting 24 hours later after 60 pounds of 5/32" Ni-Rod "55" were used to repair it.

Close the mill for...

2 MONTHS *to* REPLACE *this casting*

OR

24 HOURS *to* REPAIR *it with Ni-Rod "55"?*

First a broken tooth!

Then the tooth lodged between the gears in the large gear case of this tube straightener.

Next, the resultant force smashed this large grey iron casting weighing about 5 tons.

Delivery on a new casting would take two months and cost several thousand dollars. In the meantime, the whole mill was backed up!

Then a smart master mechanic suggested welding.

So a specialist experienced in welding cast iron was called in.

He examined the casting which had broken into three pieces – the cross section at the breaks being 3" to 4".

His recommendation was Ni-Rod "55."

60 pounds of 5/32" Ni-Rod "55" and twenty-four hours later the job was finished – the casting was saved!

They did the job without pre-heating, using successive passes and peening each bead. After welding, the excess metal was ground off and the casting was ready for service. Thousands of dollars and two months' operating time were saved!

Here is an excellent example of how vital materials and parts can be saved with Ni-Rod.

And that's doubly important today when production is essential. Ni-Rod is playing an important role in defense and you may not be able to get all you need. However, you can always depend on INCO's Technical Service Section for help on your welding problems.

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BETTER WELDING
Faster, Easier with

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CYLINDER POWER

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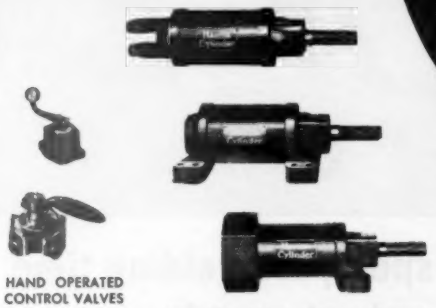
EXACTING VALVE CONTROL



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Improving welding operations is another one of the thousands of applications throughout industry where Hanna Cylinders are at work improving performance, speeding production, cutting costs.

Hanna Cylinders are available in low pressure models that operate by air, oil or water up to 250 p.s.i. and in high pressure hydraulic models operating to 1500 p.s.i., in a range of mounting styles to meet all requirements. Hanna Valves, including hand-operated, foot-operated, solenoid, pilot and speed control valves, are available to provide the finest combinations of controls for desired circuit arrangements.

Have an experienced Hanna Sales Engineer help you decide on where and how you can use Hanna Cylinder Power to advantage in your plant.

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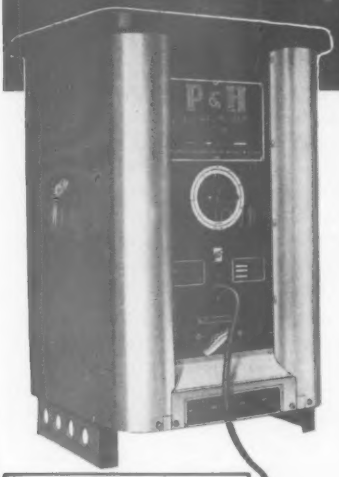
THAT P&H AC WELDER LOOKS GOOD TO ME, JIM. WE CAN GET IT OFF THE FLOOR —AND HAVE MORE ROOM TO WORK!
THAT'S RIGHT, BILL— AND WITH CONTROL AT THE WORK WE GET MORE DONE, AND DO IT BETTER!



Save floor space, cut welding time for more production at lower cost

. . . . use P&H AC Arc Welders with exclusive Dial-lectric remote control

Give yourself more room for your production needs. Mount your P&H Welder off the floor, out of the way.

Dial-lectric remote control lets you do this. Your operator can turn the heat on *at the work.* It also cuts down his "walking time" . . . turns it into *welding* time for increased output.

Besides saving space P&H Dial-lectric control eliminates cores, coils, sprockets, gears and other moving parts that cause excessive maintenance and downtime.

P&H AC Welders are available in a full range of sizes up to 625 amps. See your P&H representative or distributor for full details on how this outstanding welder can save you time and money.

Specialized Training

Metal Welding Fabrication

1 week to 18 months

Harnischfeger Welding Training School

in conjunction with

Milwaukee School of Engineering

Write to P & H today for further details

HARNISCHFEGER CORPORATION

Welding Division

4513 WEST NATIONAL AVENUE
MILWAUKEE 14, WISCONSIN

P&H

WELDING DIVISION

4513 W. National Avenue
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HARNISCHFEGER

CORPORATION

Excavators • Overhead Cranes • Hoists • Arc Welders and Electrodes • Soil Stabilizer • Crawler and Truck Cranes • Diesel Engines • Cane Loaders • Pre-assembled Houses

2257

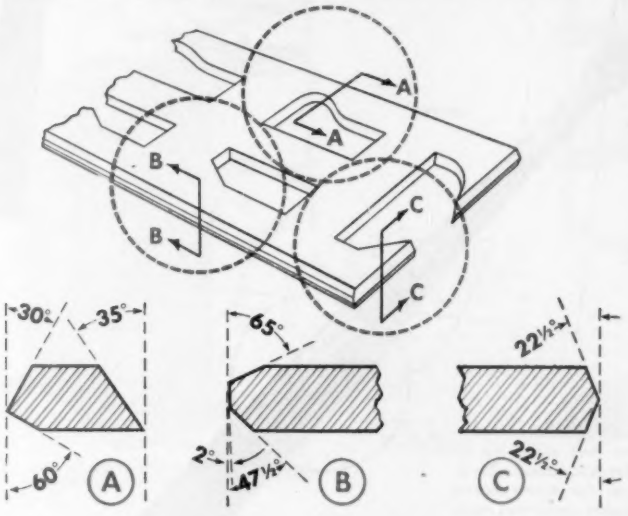
You asked for it . . . now Acetogen brings you

A Complete— STEEL FABRICATION SERVICE

— the only one of its kind

You undoubtedly have heard or read about the amazing Acetogen Process—the new way of flame-cutting armor plate and other steel to ±1/8 inch tolerance. *Now*, Acetogen offers you a *complete* steel fabrication service which employs this advanced flame-cutting method. You can have the toughest of fabricating jobs done for you *better, cheaper and faster!* Here's why:

The Acetogen Process of plate-edge preparation is so accurate, we can *flame-cut* steel to very close tolerances. *No longer is it necessary to grind an intricate bevel or radius.* Look at this example . . . a drawing of a finished plate which others must *grind* to required tolerances, but which we *flame-cut* to the same tolerances!



You can quickly see the tremendous savings effected by the Acetogen Process when applied to a complete fabricating job. We *don't* need expensive grinding machines or operators, we *don't* spend extra hours grinding plate edges to tolerances. We pass on *to you* a saving in both time and money!

And there are other advantages. Plate edges prepared by the Acetogen Process have a sufficiently low Brinell hardness to allow machining. Plates are ready for welding without *any* further preparation. Above all, *they are precise!*

A New, Fully-Equipped Plant

The modern Acetogen plant contains all the machine tools necessary to do a complete fabricating job (welding, forming, and sub-assembling) on armor plate, low-carbon and high-alloy steels, as well as on all other types of metals. It is operated by men thoroughly experienced in the working of these metals for both ordnance and aircraft applications.

Send us your drawings, sketches, or blueprints *now* for any fabricated work you have, and we will promptly quote price- and time-schedules. Our organization has full security clearance to contract for defense work through the Department of the Army, Philadelphia Ordnance Division. Let Acetogen take your fabricating problems off your hands! *Write today!* Acetogen Fabricators, Inc., Room 822, Commercial Trust Building, Philadelphia 2, Pa.

Originators of precision flame-cutting

ACETOGEN FABRICATORS, INC.

...after nine years steady use

STANDARD STEEL TREATING CO.
Harris Calorific Sales Co.
7401 Dubois Street
Detroit 11, Michigan
Gentlemen:
We thought it might be of interest to you to know that after nine years steady use we find it necessary to finally replace one of our #16 Harris Automatic Torches.
This torch is one of a number of this type in use in our straightening department and we can state without reservation that all have given exceptional service at practically no maintenance expense except for tip replacement.
Very truly yours,
STANDARD STEEL TREATING CO.
James D. Thompson, Gen. Mgr.

practically no maintenance expense...

To the advantages named in Mr. Thompson's unsolicited letter, important as they are, we must add another that might not be obvious to those who have never used a Harris Automatic Torch. That is, in nine years of continuous operation the thumb control lever (circled at right) must have been actuated many thousands of times. Each and every time it saved money. Using it to restore the full flame from pilot light eliminates the time, motions and gases wasted in flame adjustment of a standard torch. Using the thumb control to shut off the full flame saves oxygen and acetylene that is wasted when the full flame burns but is not applied to work. All these things combine to yield a tremendous return on torch investment.

Harris Distributors, located in all principal Cities, are at your service. There's no better time than now to act!

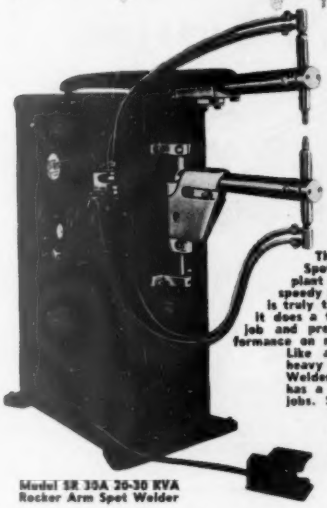
THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

DESIGNED
For Speedy, Steady Production . . .
Banner



Model SR 30A 20-30 KVA
Rocker Arm Spot Welder

These two Banner Rocker Arm Spot Welders will help gear your plant for peak production! The speedy 20-30 KVA Rocker Arm Welder is truly the race horse of the team as it does a fast, accurate production line job and provides a wide range of performance on mild steels.

Like a work horse in its steady operation on heavy duty work, Banner's 50-75 KVA Spot Welder delivers continuous high production . . . has a capacity to do a variety of welding jobs. Special design features of both machines provide a 1 to 1 ratio on the 24" throat permit welding of certain applications usually done only on a Press Type Welder.

Model SR75A 50-75 KVA
Rocker Arm Spot Welder

Banner Welders Offer Outstanding Construction Features

FRAME: Sturdily constructed of heavy 3/8" boiler plate formed and securely welded. For easy servicing the 50-75 KVA machine has detachable side panels and the 20-30 KVA unit has a large rear door.

CONSTRUCTION: Heavy castings of special, hard, high strength, high conductivity copper alloy are employed throughout the 50-75 KVA model. Enclosed heavily ribbed rocker arm is of grey iron casting mounted in a pivot pin assembly with Oilite bushings.

50-75 KVA welder has a 28" dimension from the pivot point to the end of the push rod connection facilitating better than 1 to 1 pressure ratio on 24" throat. This unusual feature permits the welding of certain applications normally practical only on a Press Type Welder.

TRANSFORMERS: Both welders operate with 220 volt or 440 volt water-cooled transformers built in accordance with industry specifications and are equipped with 8 point Heat Selector switches, the larger units having the series/parallel type permitting heavier duty.

Carefully engineered construction of 50-75 KVA Banner Welder makes it the leader in the field. Advantages are: *fast action*—capable of approximately 180 spots per minute—and *accurate performance* due to balanced moving parts and Oilite bushings throughout. Quality accessories include double-acting air cylinder, four-way solenoid valve, regulator, strainer and gauge.

BANNER is in a NEW Home!

To meet the growing demand for its welders, Banner announces the opening of larger and greatly expanded facilities for the manufacture of their resistance welding equipment.

Specific data sheets and catalog available. Write today!

BANNER MANUFACTURING CO.

6822 NORTH 43rd STREET MILWAUKEE 9, WIS.

Banner manufactures a complete line of Gun, Seam, Rocker Arm and larger Press Welders and Specials to 200 KVA. Inquiries Invited.

LOOK FOR THIS SIGN ... *when you want* **TOP QUALITY WELDING and CUTTING EQUIPMENT at MODERATE PRICES**

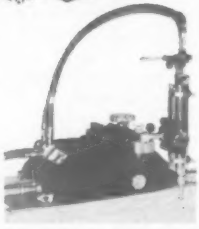
AUTHORIZED DISTRIBUTOR OF

K-G

Welding and Cutting Equipment

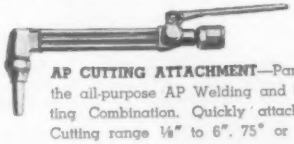
THIS new K-G display sign (colored blue and gold) identifies K-G Distributors located in principal cities throughout the country. Wherever you see it, you can be sure that you'll find efficient, dependable equipment at reasonable cost. All the products in K-G's complete line are designed for easy, fatigue-free use, and are built of the finest materials for ruggedness and long life.

DISTRIBUTORS PLEASE NOTE: We have a few sales territories open. If there is no K-G Distributor in your area, we invite you to apply for a franchise.



K-G "CUT-A-LINE" MACHINES—Model 1000, Portable. Straight lines, circles, irregular contours.

Above: **M38 CUTTING TORCH**—impervious to flash-back! 75°, 90° or 180° head—top, bottom or latch lever. **AP WELDING TORCH**—tip sizes 00 to 10 (drill sizes 76 to 30). Part of the all-purpose AP Welding and Cutting Combination.



AP CUTTING ATTACHMENT—Part of the all-purpose AP Welding and Cutting Combination. Quickly attached. Cutting range ⅛" to 6". 75° or 90° head.

Also Pressure Regulators, Complete Outfits and Accessories

CATALOG ON REQUEST

THE K-G EQUIPMENT COMPANY (Inc.)

Dept. A, 50 Broadway
New York 1, N. Y.

K-G

A UNIT OF Air Products INC OXYGEN GENERATING EQUIPMENT

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

KG ...Since 1914, symbol of satisfaction on GAS WELDING AND CUTTING EQUIPMENT

SMOOTH SURFACE
Assures Free Flow

FLOWLINE
TRADE MARK

STAINLESS STEEL, MONEL, NICKEL and INCONEL WELDING FITTINGS

For Dependable Corrosion Service

Free flow is a fundamental requirement of a piping system for corrosion service. The use of FLOWLINE fittings provides a smooth interior surface — without scratches, ridges, pockets, or sharp corners.

All FLOWLINE fittings — of which the 90° ell shown above is typical — include unique features that have been developed through our long specialization in the design and production of welding fittings for corrosion service.

The Welding Fittings organization was the first to standardize, manufacture, and stock a complete line of stainless welding fittings. Tees, ells, reducers, stub ends, and caps are available in sizes ½" through 12", in various pipe schedules.

Features of *FLOWLINE* Ells

WELDING FITTINGS CORP.

NEW CASTLE, PENNSYLVANIA

World's Largest Manufacturer of Stainless Welding Fittings

an all-year Christmas present

THE ALL NEW— MULTI-PURPOSE AIRCO NO. 20 RADIAGRAPH

Yes, sir, here is a year-round "Christmas Present" for your shop — a portable gas cutting machine that will perform a wide range of metal cutting jobs. It is the first portable gas cutting machine built to carry Aircomatic®, Heliwelding, Flame Hardening and other fabrication equipment.

A streamlined aluminum body, featuring a specially designed carriage top, is part of the "behind scenes" versatility of this invaluable new fabrication tool.

So, if you want to speed up metal cutting operations—and step up fabrication schedules—use the NEW Airco No. 20 Radiagraph. It will cut straight lines and circles with square edges, single or double bevels, with or without land; as well as shape (with guide rollers) small steel parts of almost any commercial thickness.

Sturdily built with a powerful new motor, sealed at the factory with lifetime lubrication, the new, lightweight (weighs only 57 pounds), Airco "20" is easy to operate, and performs all its cutting operations—with "Airco Accuracy".

Call or write your nearest Air Reduction office for full details about the NEW Airco No. 20 Radiagraph. Ask for descriptive literature.

AIRCO

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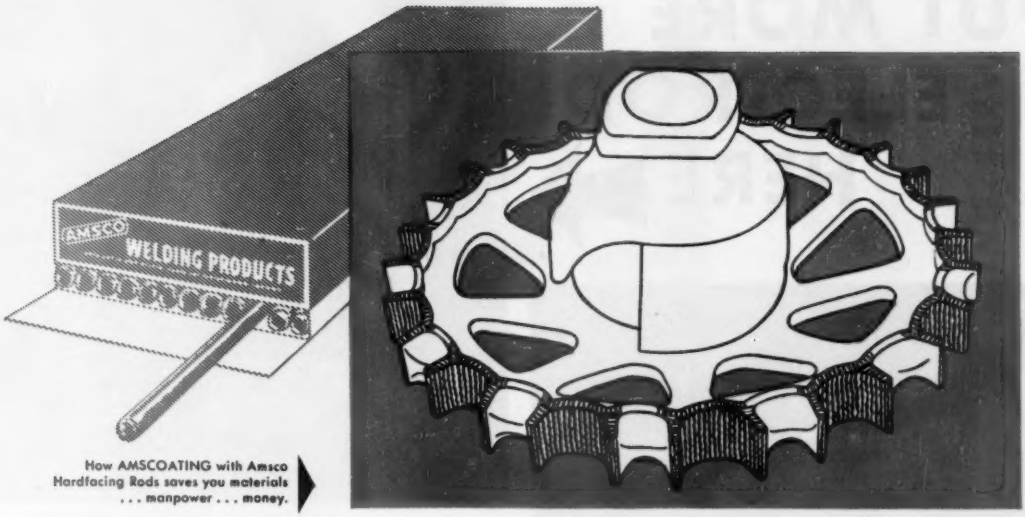


How AMSCOATING with Amsco Hardfacing Rods saves you materials . . . manpower . . . money.

These teeth take bites out of repair costs!

AMSCOATING can make old Tractor Drive Sprockets last 3 times longer than new.

Here's another way to beat the high cost of replacements, down-time and maintenance . . . AMSCOATING the teeth on Tractor Drive Sprockets. Time after time service records have shown that AMSCOATING of sprockets results in these dollar-saving advantages:

1. ***On an average — 3 times the service life of a new, unhardfaced sprocket.***
2. ***2 out of 3 sprocket changes completely eliminated . . . far less down-time, less maintenance . . . more equipment out of the shop and on the job.***

To top it off, sprocket replacements can practically be eliminated. An AMSCOATED sprocket can be reclaimed over and over again . . . *at about half the cost of a new one!*

Get all the facts on how to make these big savings . . . write today for instruction sheet on AMSCOATING sprockets, and the name of your nearest AMSCO Distributor.

AMSCOATING stands for control of wear by Hardfacing...

Hardfacing rods—and recommendations for their use—are as sound as the manufacturer who makes them. AMSCO has been fighting wear for a half-century—first with Manganese Steel, and later with AMSCO Hardfacing Products.

If you have a problem of wear caused by impact, abrasion, heat or corrosion . . .

Find out how AMSCOATING can save you materials . . . manpower . . . money!

AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
382 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St Louis. In Canada: Joliette Steel Division, Joliette, Que.

PUT MORE ELECTRODE HERE

LESS HERE

Good technique and the right rod for the job reduce electrode waste

You can deposit more weld metal in less time and avoid wasting electrodes by using the right electrode for the job, approved techniques, and by following the manufacturer's recommendations. G-E electrodes give you high deposition rates, meet AWS specifications, and are available in a wide variety of sizes and types.

Fig. 1. *Three* electrodes used straight may give as much production as *four* which are bent before being used.

Fig. 2. *Three* electrodes burned down to a 2-inch stub may do as much as *four* when "long" stub ends are left.

Get more from your electrodes today by:

1. **Laying flat-face fillets on vertical fillet welds**
2. **Making fillet legs of equal length on horizontal fillets**
3. **Providing better "fit-ups"**
4. **Protecting welding rods through better storage and care**
5. **Avoiding bending whenever possible**
6. **Using electrodes down to a 2-inch stub**

Bending electrodes wastes about ¼ of their useful length (Fig. 1) as does the habit of throwing away "long" stub ends (Fig. 2).

NEW! Welding Electrode Slide Comparator tells in an instant the AWS designation of manufacturer's electrodes.

See your G-E Welding Distributor for your comparator. Look for General Electric under "Welding Equipment" in the yellow pages of your telephone directory. And remember, he carries a complete line of G-E welders, electrodes and accessories.

GENERAL ELECTRIC

712-7

WELDOLETS

WELDING FITTINGS FOR ANY PIPING SERVICE

NATURAL GAS COMPRESSOR STATION PIPING CONSTRUCTED ECONOMICALLY AND EFFICIENTLY USING WELDOLET WELDING FITTINGS THROUGHOUT

This installation, together with a number of important applications of WeldOlet Welding Fittings in various types of service is shown in the new Bonney W-3 WeldOlet Catalog.

The completely new Bonney catalog will furnish descriptions, dimensional information and installation instructions. The technical section demonstrates graphically how WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with code provisions.

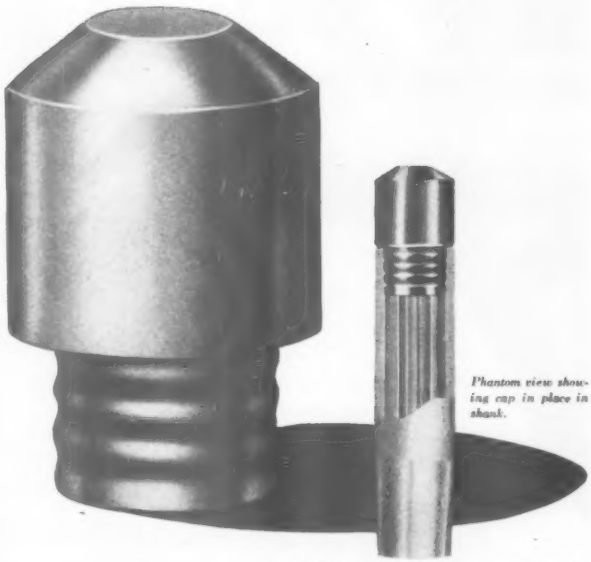
Write for your free copy to BONNEY FORGE & TOOL WORKS 106 Union St., Allentown, Pa.
Export Distributor: NATIONAL SUPPLY EXPORT CORP., 250 Park Ave., N. Y. 20, N. Y.

Don't Miss the New Mallory "Nu-Wrinkle Cap"*

ELECTRODES for Resistance Welding

- Easily replaceable cap cuts costs, conserves copper
- Corrugated skirt provides positive contact with shank
- Positive alignment between cap and shank
- Makes a readily replaceable insert for welding dies
- Large cooling area in cap skirt
- Fluted** water hole in shank
- All standard Mallory nose shapes

For complete information, write direct or contact your local Mallory distributor.



Phantom view showing cap in place in shank.

*Trade Mark, Pat. Applied For **Pat. Pending

Resistance Welding Electrodes, Holders, Dies, Rod and Bars, Castings, Forgings

P. R. MALLORY & CO., Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Electromechanical Products

Resistors *Switches*
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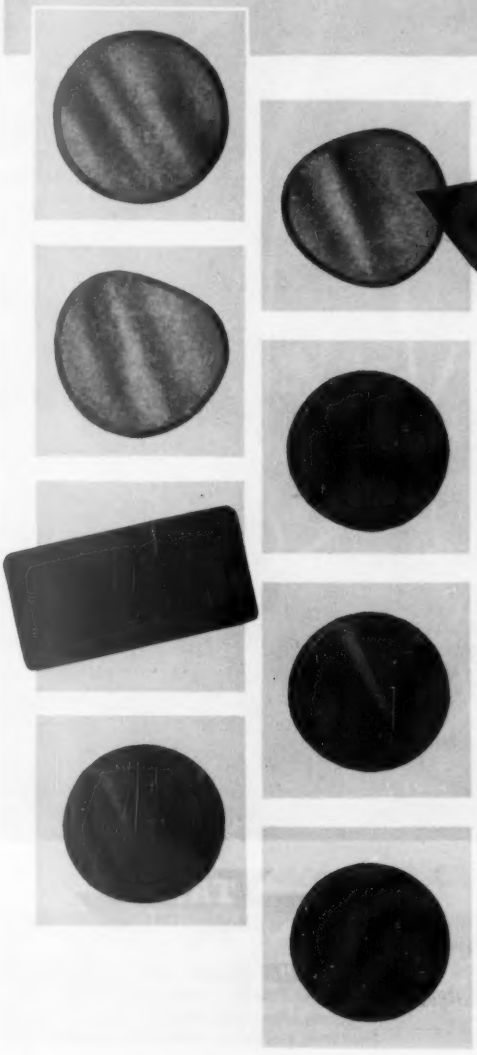
Contacts *Special Metals*
Welding Materials

Order this line direct!



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INDUSTRIAL LENSES

SAFETY AT A SAVING

Now you can save substantially on premium quality industrial lenses! Order them direct from one of America's oldest makers of fine ophthalmic products.

Penoptic* industrial lenses exceed all Federal specifications, are *individually* precision ground and polished to the most exacting standards. The complete line includes welding, safety and cover lenses. Write or telephone (Reading 4-8397) your order to

PENNSYLVANIA OPTICAL COMPANY
READING, PA.

Known for Fine Ophthalmic Products Since 1886

*PENOPTIC *is the trade name of Pennsylvania Optical Company*

PENNSYLVANIA OPTICAL COMPANY
Reading, Pa.

Please send me the following folders and price lists:

_____PENOPTIC Welding and Cover Lenses

_____PENOPTIC Safety Lenses

NAME _____

ADDRESS _____

CITY & STATE _____

IMPROVED WELDS WITH RUFLUX P Manufacturers of welding rods find that welds of superior quality are produced when TAM Ruflux P is included in the rod coating formulation. RUFLUX P aids in arc stabilization and the formation of satisfactory slags. Complete information sent on request. Write our New York office today.

*TAM is a registered trademark.

TAM PRODUCTS
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TITANIUM ALLOY MFG. DIVISION
NATIONAL LEAD COMPANY

Executive and Sales Offices: 111 BROADWAY, NEW YORK CITY
General Offices, Works and Research Laboratories: NIAGARA FALLS, N. Y.

NEW DryRod Electrode Oven

stops moisture pickup in low-hydrogen electrodes

Problem: Unprotected low hydrogen-ferritic electrodes absorb hydrogen-generating moisture

Solution: DryRod, required equipment, controls moisture content to approved standard of .2%

First in the field and *proven in use* by leading fabricators throughout the country, DryRod solves the problem of moisture pickup in mineral-coated electrodes. DryRod, developed with the assistance of major electrode manufacturers, preserves original "baked-in" quality by automatically controlled temperatures to 550° F . . . always keeps electrodes at highest efficiency. This means better quality welds . . . less rework, less scrap . . . *lower cost per weld.* Be sure to write for all the facts TODAY.

Ask for a demonstration

DryRod gives you all these features

- Electric tubular heaters—plugs into 110-220V line
- Adjustable temperature control 200-550° F—equal heat distribution
- Insulated—low heat loss
- Capacity—350 lbs.
- Vented—adjustable regulator
- Removable perforated shelves
- Sturdy, all-welded flanged heads
- Light weight, only 102 lbs.

Philip Roden Co.

1723 E. Lake Bluff Blvd. MILWAUKEE 11, WIS.

To meet every INDUSTRIAL X-RAY NEED

X-RAY

There's no need to improvise or compromise when you buy a General Electric Industrial X-Ray Unit. The comprehensive GE line makes possible the selection of just the right unit to match the type of inspection desired throughout your manufacturing process.

More than a half century of x-ray development, including the pioneering of industrial x-ray apparatus, is reflected in this highly versatile array of industrial x-ray units. Chances are, there's a need for x-ray in your business. Lower your production costs and improve quality. Let one of General Electric's highly-trained application specialists appraise your inspection needs. For full information write — X-Ray Department, General Electric Company, Milwaukee 14, Wisconsin, Box AE-11.

You can put your confidence in —

GENERAL ELECTRIC

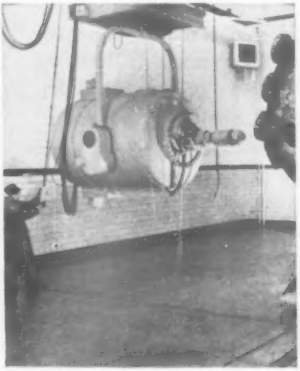
XRD-3—This x-ray diffraction apparatus provides for the use of modern techniques for the study of crystal structures and the relation of these structures to the physical properties of nearly all solid materials.

OX-140 — Extremely versatile and efficient . . . with a continuous operating range of from 30 to 140 kvp at 5 to 10 ma. Available in six different models. Invaluable for inspection of low-density metal and other materials.

OX-250 — The world's most popular industrial x-ray unit . . . with an operating range from 60 to 250 kvp, 2.0 to 10.0 ma. This rugged unit is available in seven different mountings to meet varied industrial needs.

OX-400 — Bridges the gap between low and high-voltage equipment. Where cost prevents installation of higher-voltage equipment, yet penetration of lower-voltage units is insufficient, this 400 kvp apparatus is a natural choice.

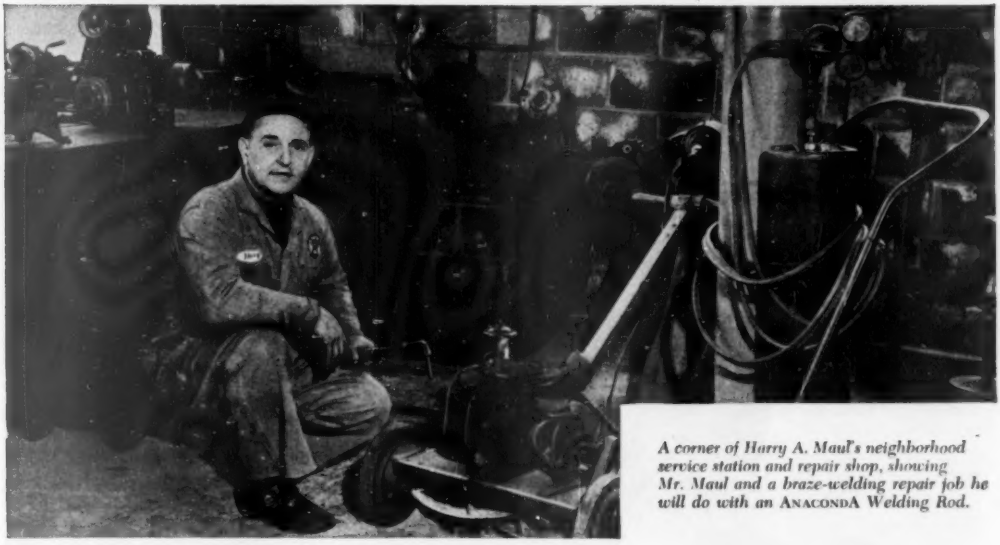
RESOTRON 1000 — The million-volt unit which opened a new era in industrial radiography. Featuring a resonant transformer, multi-section tube, and gas insulation, it operates at 1000 kvp, 3.0 ma, continuous rating.



RESOTRON 2000 — As with the Resotron 1000, this two-million volt unit permits the use of the large-field, reflected x-ray beam for simultaneous radiography of many objects in a single exposure . . . Faster, with greater penetrating power.

15 MILLION-VOLT BETATRON — The present-day ultimate where maximum sensitivity is paramount. Your best choice in magnetic accelerators, for speed, sensitivity, and field size for the radiography of heavy section thicknesses.

"ANACONDA **Welding Rods** helped my shop become a real service center!"



A corner of Harry A. Maul's neighborhood service station and repair shop, showing Mr. Maul and a braze-welding repair job he will do with an ANACONDA *Welding Rod.*

Mr. Maul points to a loose crankcase drain plug insert he will braze-weld for a neighborhood customer with an ANACONDA *Bronze Welding Rod.*

"I run an automobile service station and repair shop at Mt. Ephraim, N.J.," explained Mr. Maul, "and I get calls to do repair welding for nearly everybody in the neighborhood—even the children.

"First off, ANACONDA Bronze Rods for braze welding give me jobs I can depend on—and in a hurry. Without a low-temperature melt, quick 'tinning' properties, and good penetration, my operations would bog down.

"See this lawn mower? It just came in and ANACONDA (Low Fuming) 997 will help me fix it. Here's another I've already fixed. Out front is a truck with a broken tailboard latch I braze-welded.

"People bring in bicycles, tools, tractors, baby carriages, sleds and wagons. I fix them all with ANACONDA Welding Rods."

Harry Maul knows the kind of rod it takes to make a good braze or weld. He uses ANACONDA Welding Rods for their strength, toughness, ease of application and moderate cost because the work requires far less preheating; and because the welds are far easier to finish. Both Mr. Maul and Morris, Wheeler & Co. Inc., ANACONDA Welding Rod Distributor, in Philadelphia, could also tell you about bronze rod for building up worn surfaces—as your own ANACONDA Distributor can. For free Publication B-13, write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

braze or weld with confidence . . . use

ANACONDA®
WELDING RODS

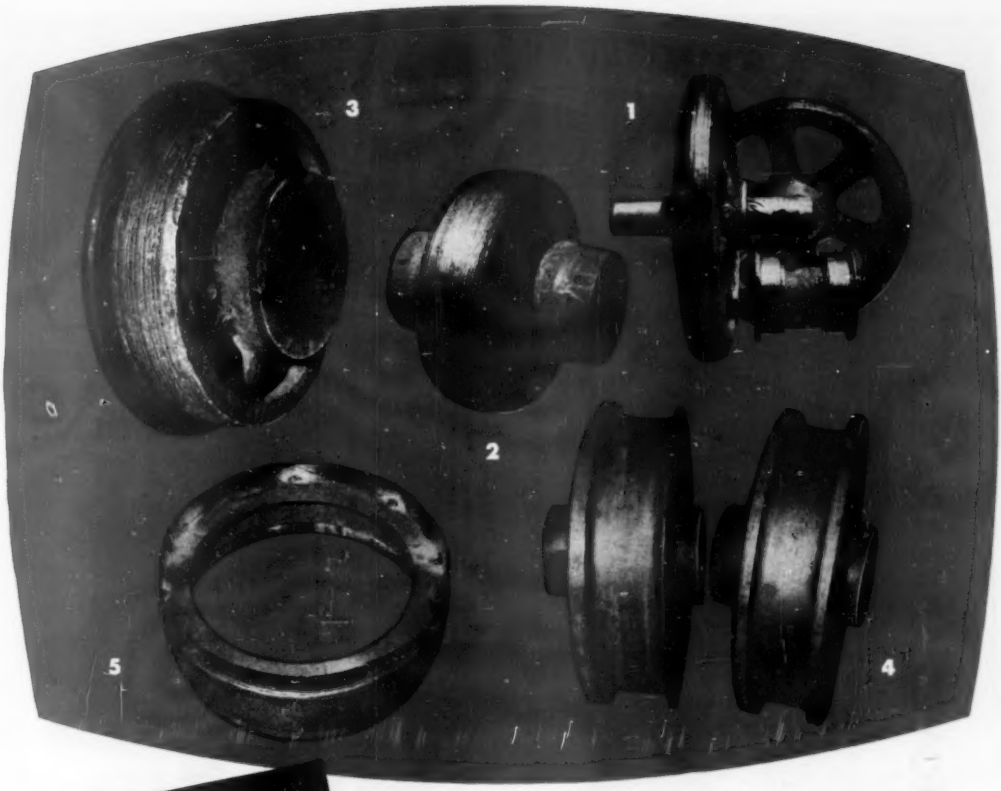
The Welder's Glove or Mitten **YOU WANT** is Here!

AO Welders' Gloves and Mittens are made from selected chrome-tanned cowhide or horsehide leather, specially tanned for maximum heat resistance. They combine protection with working ease because they are cut to "king" size for freedom and comfort. The leather is tough enough for the hardest service yet remains soft and flexible. Sleeves tuck neatly into gauntlets for secure protection for forearms and wrists. The lining does a 3-way job — helps prevent chafing, absorbs perspiration, gives extra insulation. Your nearest AO Safety Products Representative can supply you.

AO's Industrial Vision Program increases *production, decreases accidents. Write today for free booklet "Improved Industrial Vision."*

American Optical
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES



1. SHOVEL IDLERS
Built up and hard-faced automatically with Stoody 105, this shovel idler and tractor roller are exceptionally smooth and long wearing.

2. SHOVEL ROLLS
Note the even deposit on this shovel roll. Stoody 105 will at least double its useful life—save hours of downtime.

3. MINE CAR WHEELS
Mine car wheels sustain heavy wear from track debris. Stoody 105 retains size and roundness—keeps wheels on the job under difficult conditions.

4. CRANE WHEELS
Here, unprotected and hard-faced crane wheels are compared. Note wear evident on flange of unprotected wheel, left. Stoody 105 has held size on wheel at right.

5. BRAKE DRUMS
Surface of this brake drum is automatically hard-faced with Stoody 105 and subsequently machined. Resulting smooth surface far outwears unprotected drum.

STOODY 105 keeps the wheels of industry turning . . .

with less wear—less down time—less cost

Everywhere you look—in almost any industry, you see wheels in use. Some work *in* earth, others operate metal against metal . . . *but almost all are subject to heavy abrasion, loss of size, loss of life!* The quick, sure way to reduce wear . . . to keep these wheels of industry rolling . . . to cut maintenance is to hard-face with STOODY 105! It's a time-tried, proven procedure that saves equipment and dollars and reduces the need for hard-to-get replacements.

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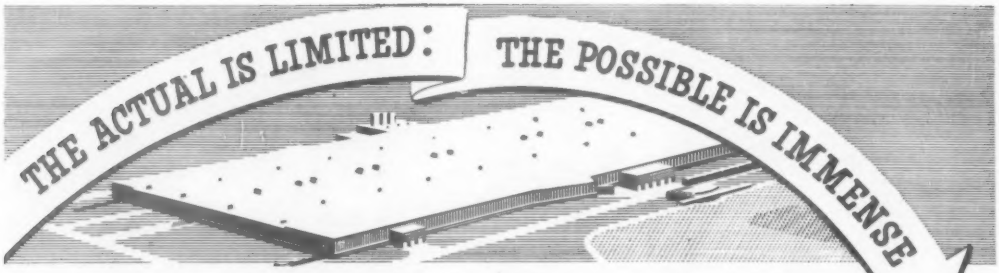

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

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DESIGN IN STEEL IMPROVES APPEARANCE

. . . lowers cost 15%

UTILIZING the economies of welded steel has cut the cost of this machine base by 15%, while achieving better sales appeal through its clean, modern appearance.

Following the features of the original base, as shown in Figure 1, the first design involved 13 separate components and required 205 inches of welding (Fig. 3). However, by taking full advantage of opportunities for simplifying details while increasing strength and rigidity, the final design, (Fig. 4) involved only 7 components and welding was reduced 40%.

Machining costs are cut sharply since welded components are formed close to finished dimensions. Changes in design for special needs of customers can now be accomplished without need for alterations in patterns.

Fig. 4—Present Design *has rigid box-type construction. Needs less material than Figure 3. Designers and Fabricators: The Boiler Repair and Welding Shop, Inc., Bridgeport, Connecticut.*

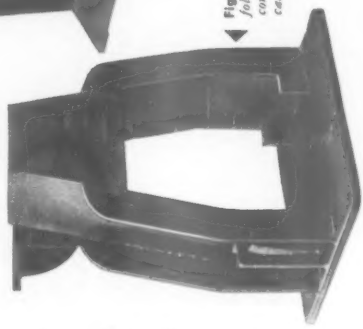

Fig. 3—First Weldesign in Steel *follows appearance of original construction. Saves on metal because steel is stronger than iron.*

WELDED DESIGN ALWAYS IMPROVES PRODUCT AND LOWERS COST

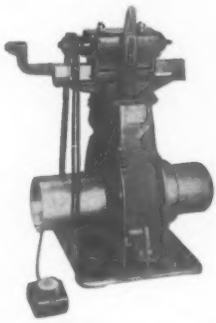

Fig. 1—Original Design *of wire straightening machine for the A. H. Nilson Company, Bridgeport, Connecticut. Required considerable machining, cleaning and finishing prior to painting.*

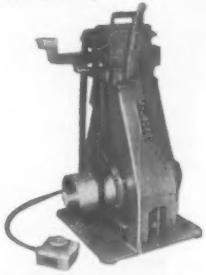

Fig. 2—Welded Design *costs 15% less. Has improved appearance . . . better selling appeal. Tests show base has greater rigidity than in original construction.*

HERE'S PROOF

Machine Design Sheets are available to designers and engineers. Simply write on your letterhead to Dept. 711.

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 17, OHIO

ESTABLISHED 1916 THE WELDING ENGINEER NOVEMBER, 1951

Still Missing the Boat!

MOST OF US have missed something: a streetcar, a bus, a train, a plane—some people have even missed a boat. Missing a means of transportation is always annoying and may cause inconvenience, but as a rule it doesn't amount to much. Another train or plane or bus will be along shortly. True, the lost time is gone forever, but perhaps we would only have wasted it, anyhow.

It's far different when a golden opportunity is lost. Here the loss is real. Rare indeed is the occasion when a golden opportunity hangs around to offer a second chance. Yet at least one such opportunity is still here, still offering the National Production Administration and the Defense Production Administration many ways for conserving critical materials. That golden opportunity is welding.

According to NPA Administrator Manly Fleischmann, structural steel orders for the fourth quarter of 1951 are 232% of production. For the first quarter of 1952, the orders now total 210% of production. Any way you figure it, less than half of the people who are asking for structural steel in the near future are going to get any.

There is, of course, no way to fulfill all of the existing orders, but it is certainly possible to extend the existing supply. One attempt has been made to do this through a "construction conservation" program. Defense Mobilizer Charles E. Wilson (who seems to have forgotten that he used to make welding electrodes) is behind a six-point plan for more widespread use of reinforced concrete. A good idea, and it is to be hoped that the welding industry will be provided with sufficient materials to meet the welding and hard-facing requirements of the quarries and cement mills.

OUR national leaders have again missed the boat. Once again they have failed to order the use of welding for structural steel fabrication. As we have pointed out repeatedly in the pages of *The Welding Engineer*, structural welding is being used from coast to coast and from border to border to save structural steel. In this very issue (page 36) appears an article telling of a 15% saving in structural steel achieved through the use of welding. That is about the average saving.

Other savings are even more spectacular. A big welded structural job in the east, now in progress, shows a 30% saving in structural steel. In the connecting of the structural members, however, the savings were nearly 90%.

It seems very nearly incredible that such a golden opportunity to extend the supply of structural steel should be shunned and ignored. Why is it that welding is not being advocated as the exclusive means for joining structural members? The answer is just plain dumbheadedness.

SOME backward people in the construction and fabricating fields aren't sure that welding is here to stay. They reason that methods good enough for grandfather are good enough today. Though such stone-age conservatism has no place in the modern engineering world, the Neanderthals, unfortunately, are able to make their influence felt.

In the critical times we now face, a continued refusal to save steel by whatever means it can be saved is a stupidity that borders on treason. Every day that we delay to use welded construction for buildings is a day that more structural steel is being wasted. How long, oh Lord, how long before there will be an awakening?

Maybe some day the order will come out that stone-age clubs are no longer in vogue in the construction field. Maybe before it's too late steps will be taken to conserve and extend the entire structural supply by using only welded construction.

Yes, our leaders are still missing the boat, but it is still waiting for them. Let's hope that the order will come soon for us all to get on board.

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Westinghouse RA Welders with new positive arc-drive control now prevent shorting when used on "drag" welding applications. In addition, they allow complete penetration on root passes of vertical and overhead welds. Arc-drive control is obtained by adjusting the ratio of short-circuit current to welding current without changing open-circuit voltage. Actual amount of arc-drive current can be varied by the operator.

For information on this improved RA Welder or other Westinghouse Welding Equipment, write Westinghouse Electric Corporation, Dept. DC76, Welding Division, Buffalo, New York.

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For a complicated connection like this, use of the TUBE-TURN Welding Cross also means extra strength. This welding cross is made from the same seamless tubing and by the same process as TUBE-TURN Welding Tees. Bursting pressures obtained in tests of representative tees and crosses have averaged more than 25% higher than required by standard codes. This gives you extra quality at no extra cost.

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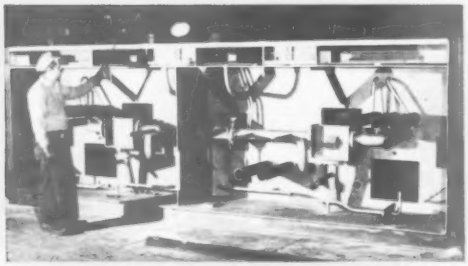
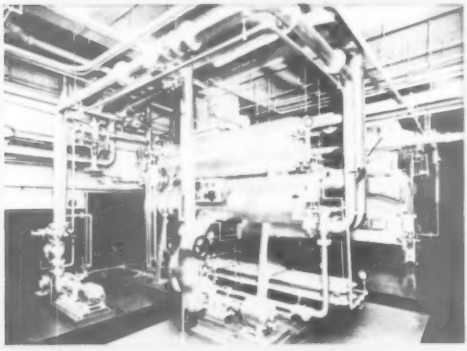
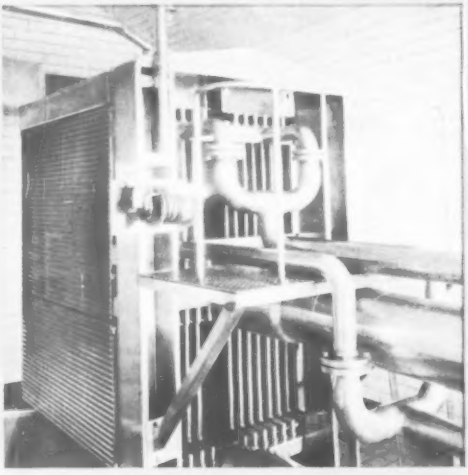


Hydroelectric projects like Grand Coulee and Hoover Dam represent a tremendous investment in equipment. So the Woodward Governor Company, builder of governors which control the big turbines, makes dependability a prime consideration. Critical piping on the governor sump base is joined with reliable TUBE-TURN Welding Fittings.

Here's the first gas turbine electric locomotive on the nation's railroads. With much of the equipment fitted into a limited space, failures in piping joints here would mean king-sized headaches. That's why piping joined with TUBE-TURN Welding Fittings is specified throughout. Despite hard usage characteristic of locomotive application, this piping stays strong.



Carrier Corp. engineers insist on rugged components for Carrier apparatus, such as this new refrigerating machine. Thus lines are welded with TUBE-TURN Welding Fittings to banish maintenance, conserve space too. The wide range of types, sizes, and alloys available in TUBE-TURN Welding Fittings and Flanges makes fabrication of a complex job like this easier.



A cool, clean bottle of beer starts with clean, leakproof equipment. That's why welded piping is used for this wort cooler, designed and used by the Falstaff Brewing Corporation. Pipe and TUBE-TURN Welding Fittings are made of stainless steel. Thus contamination, internal or external, is guarded against. Such installations assist Falstaff's premium quality control program, and help keep the plant spic and span.

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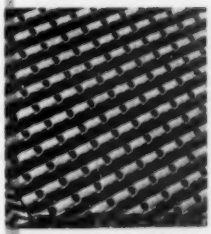

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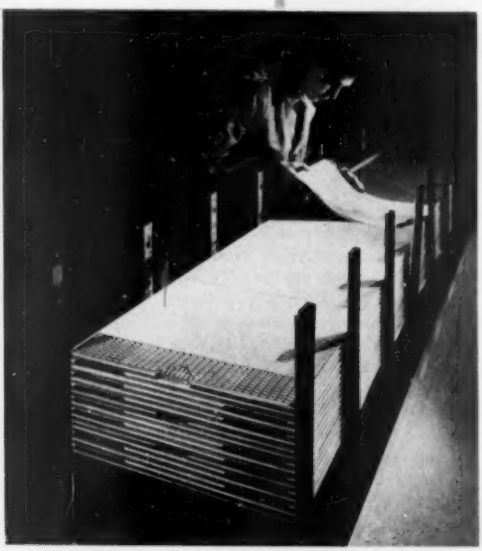
hangers

nt or flying range could correspondingly. Besides iew heat exchangers have or railroad and bus air and for a variety of petroleum processes.

February of 1951, the aluminum heat-transfer onstructed have been op- ssfully in a large "ton- " plant built by Air Prod- lentown, Pa. These ton- units withstand contin- on and removal of pres- 00 psi, while the alumi- exchange heat between peratures ranging from —300 F.

recently built for chem-

2—PRESS STAMPS fins from strip aluminum. Press-man is cutting one of the crimped sections to length



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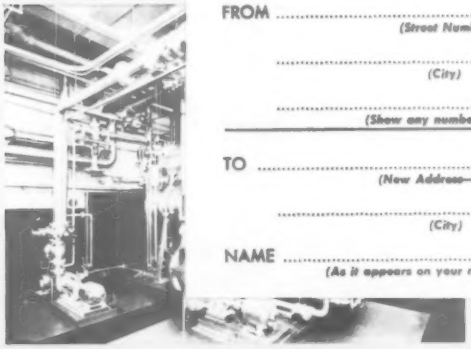

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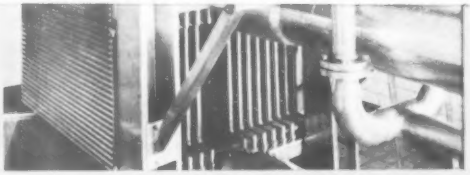

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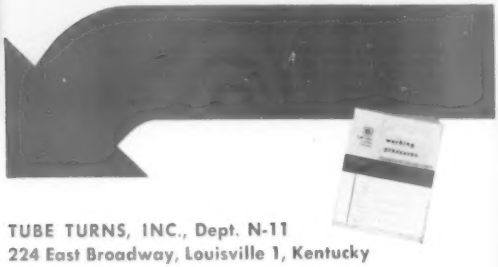

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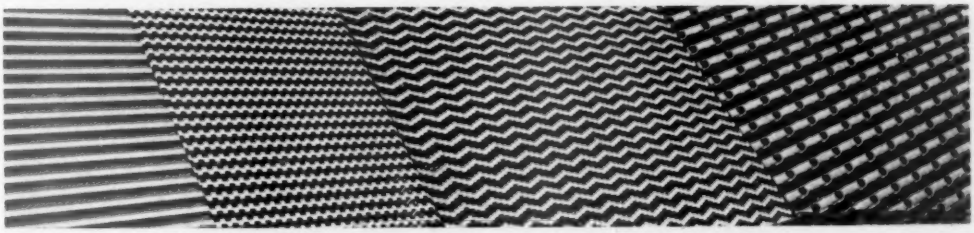


1—CORRUGATIONS from left to right are: straight fins, serrated fins, triple-serrated fins and perforated fins

New Wrinkles in Heat Exchangers

Corrugations pictured above don't exhaust the new wrinkles Trane Co. has thought up for aluminum heat exchangers. The brazing method is a new wrinkle, too.

BY CLYDE B. CLASON

NEW brazed aluminum heat exchangers can perform their tasks of heat transfer in one-fourth the space with one-third the weight and approximately half the cost of comparable conventional units. According to engineers of The Trane Co., La Crosse, Wis., the originator of this product, some of these units pack up to 450 sq ft of heat-transfer surface into one cu ft of space—nine times the surface that is in a conventional shell-and-tube exchanger with ¾-in. tubes.

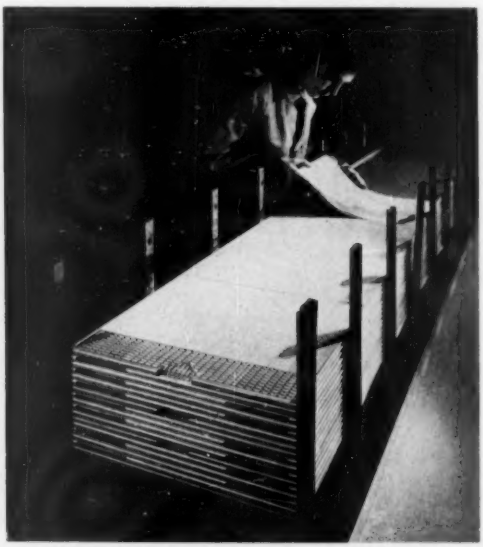
Aircraft to Oxygen Plants

The Trane flux-brazing method was developed during World War II to create compact, lightweight aircraft intercoolers, radiators and exhaust gas heaters. The new method reduced weight of a single-engine fighter plane by as much as 500 lb, which meant that armament or flying range could be increased correspondingly. Besides aircraft, the new heat exchangers have been used for railroad and bus air conditioning and for a variety of chemical and petroleum processes.

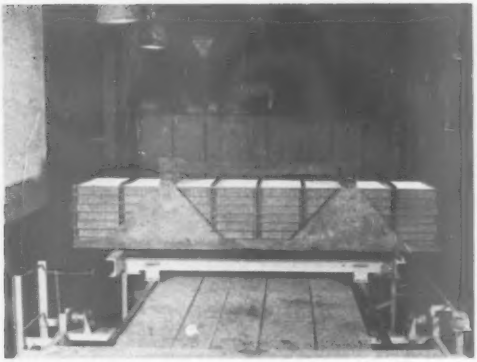
Since mid-February of 1951, the first big-scale aluminum heat-transfer units to be constructed have been operating successfully in a large "tonnage-oxygen" plant built by Air Products Inc., Allentown, Pa. These tonnage-oxygen units withstand continual application and removal of pressures up to 100 psi, while the aluminum walls exchange heat between gases at temperatures ranging from 80 F down to —300 F.

Other units recently built for chem-

2—PRESS STAMPS fins from strip aluminum. Pressman is cutting one of the crimped sections to length



3—ASSEMBLING the corrugated fin sections between flat aluminum plates to make "core" of heat exchanger



4—IT'S NOW ready to enter preheat oven. Aluminum core to be brazed is locked securely in the steel jig

5—FLUX BATH near 1,100 F does the actual brazing. Here the brazed core is being inspected as it emerges

ical processes have been tested at pressures up to 1,000 psi and at temperatures ranging from —300 F up to 500 F. In general, operating pressures are running from 100 to 300 psi, and test pressures from 300 to 600 psi. One test core was subjected to more than 2,000,000 reversals of 100 psi pressure.

Progress was made possible by the development of a successful method for brazing the complicated assemblies. Though aluminum has proved a wholly satisfactory material for heat exchangers, Trane engineers do not mean to rest there. A similar method for brazing exchangers of stainless steel and Inconel has been worked out in the laboratory and is now undergoing testing.

Brazed aluminum heat-exchange surface is one of the most complicated and difficult products there is to manufacture, asserts H. Corbyn Rooks, Trane vice-president. However, the difficulties of manufacture are offset to a considerable degree by such advantages as: (1) compactness—the ability to perform a job in limited space; (2) low cost per Btu; (3) light weight and (4) flexibility. With regard to the important fourth point, a unit can be designed to fit almost any combination of specifications for heat transfer, pressure drop, volume of flow and number of fluids to be handled. Extended surfaces of brazed aluminum may be designed for heat exchanges from gas to gas, from gas to liquid or from liquid to liquid.

A Corrugated Sandwich

The basic design of the heat-exchange surface is a layer of corrugated fins sandwiched between flat plates. The plates are closed on the end, forming separate passages in which gases and/or liquid can circulate between the plates. The corrugated layer between the plates can take many forms, depending upon the job requirements. The corrugations can be straight and continuous, forming parallel rectangular passages. Heat-transfer characteristics of such passages correspond roughly to those of tubes with the same cross-sectional area.

To provide an interrupted passage for the fluid flowing between the plates, the corrugations can be serrated. This creates additional turbulence and higher heat transfer. Corrugations may also be manufactured with a "herringbone" or wave design to provide yet other heat-transfer performance characteristics. This list by no means exhausts the range of possibilities. Some of the many patterns that may be made appear in Fig. 1.

Conventional heat exchangers are limited to two streams, but the new types may be built up for as many as five different streams of gas or liquid. These streams may flow across each other, parallel to each other or in opposite directions. Streams may be taken off at any point along the length of the exchanger—a feature not readily available with other equipment.

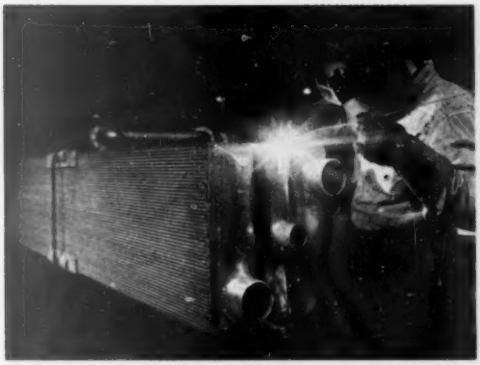
No matter how complicated a heat exchanger may be, it is built up of alternate layers of corrugated fins and flat sheets of aluminum. The tough part of the production lies in brazing these components together. The bond is produced by melting a thin coating of brazing alloy, applied when the aluminum is rolled to either one or both sides of the sheet as ordered. One of the first steps in the production of heat exchangers is to inspect the clad sheets as they are delivered from the mill to make sure that the alloy coating is uniform and satisfactory for brazing.

Fabricating a Heat Exchanger

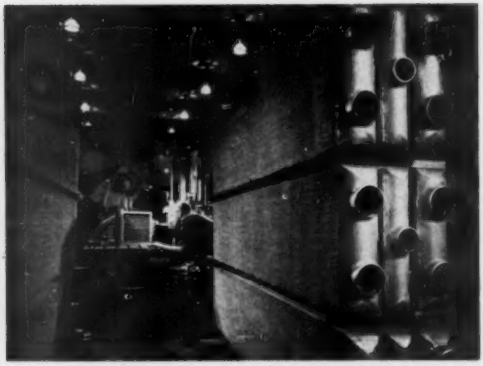
The accompanying photos show how the fabrication is accomplished. In Fig. 2, fin pressman Coy Sitze is cutting to length a section of triple-serrated fin surface after it has been formed. The specially designed fin press will crimp aluminum strip into whatever pattern is desired—simple corrugated, serrated, perforated or herringbone. Thickness of the triple-serrated fins shown in Fig. 2 will be checked carefully by gages before assembly begins.

Let's now watch a large brazed heat-exchanger core take shape. In Fig. 3, worker Thomas Hartley assembles the corrugated fins between flat aluminum plates. The steel jig in which assembly is done will also serve to hold the core during the brazing process. If you will look closely at the left foreground of this picture, you can see that each layer has a separate opening through which it receives (or discharges) a stream of liquid or gas. The perforated fins serve to distribute the fluid evenly across the layer. Headers, to be welded on this core after assembly, will supply three streams of fluid.

After assembly, the aluminum core is cleaned with hydrochloride acid



6—HEADERS are inert-arc welded to tank. Tank has been torch brazed to the core, an operation not shown



7—HUGE CORES for oxygen plant make a startling contrast to original aircraft intercooler (in center)

in order to remove oxide. The acid is washed away by a cold water rinse. Still in the same steel jig (Fig. 4), the heat-exchanger core enters the preheat oven, where it will be heated gradually to a temperature below the melting point of the aluminum-silicon brazing alloy.

When preheated to the desired temperature, the assembled core is plunged into a cherry-red bath of flux that is very close to the 1,100 F melting point of the brazing alloy. The temperature must be held to within a tolerance of 10-20 F throughout the job. Precise control of preheating, flux-bath temperature and cooling is a fundamental to the success of the difficult brazing task. In Fig. 5, worker John Johnson, his face safeguarded by a heat shield, inspects the core as it emerges from the flux bath.

To remove all traces of flux, the brazed core is cleaned by steam and by acid baths after brazing. After cleaning, it is given a chemical test to make sure that it is as clean as it is possible to make it.

Headers Welded On

Fabrication of the individual aluminum heat exchanger is completed by two welding operations: (1) torch brazing a tank to the core and (2) inert-arc welding headers to the tank. In Fig. 6, weldor Anton Wallace is doing the inert-arc welding job to add headers. The core on which Wallace is working provides from 7,000 to 8,000 sq ft of heat-transfer surface.

How the original aircraft "intercooler" looks when contrasted with a huge oxygen-plant heat exchanger may be seen in Fig. 7. The machinist, A. H. Dopson, is milling the surfaces of an aluminum aircraft intercooler of simple cross-flow design. In the foreground are some of the large heat-exchanger cores that are now serving in the previously mentioned tonnage-oxygen plant built by Air Products, Inc.

The intercoolers were first fabricated for military aviation orders in World War II in order to cool the hot, high-pressure air from engine superchargers to temperatures suitable for efficient combustion. The brazed aluminum jobs replaced soldered copper intercoolers and radiators late in the war, reducing the weight of fighters and bombers and thus contributing toward higher ceilings, greater ranges and heavier armaments.

After the war, the small brazed heat exchangers found a relatively limited use in the compressed air coolers and lightweight air conditioners installed in railroad cars and buses. Of recent months, however, production of the small heat exchanger has been stepped up considerably by the expansion of jet aircraft production.

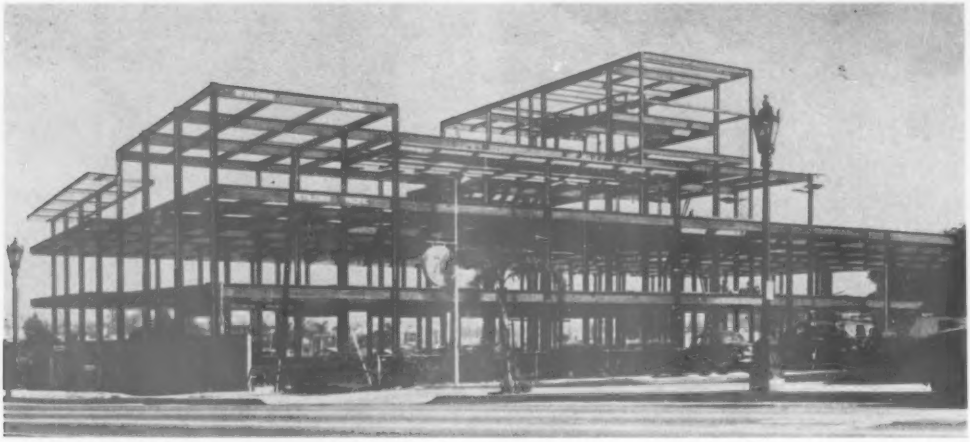
Development work on the larger units that are needed for chemical processing and similar applications has continued steadily since World War II. Because tooling for individual designs is expensive, Trane's present production is limited to large heat-exchanger batteries (one battery furnished has over 90,000 sq ft of surface and costs several hundred thousand dollars) or to production runs of smaller units. The heat exchangers already completed or under construction for oxygen plants, chemical plants and military aviation are typical of these large orders.

Trane, however, has an eye on the development of other volume markets. It is, for instance, economically feasible to employ the new-type heat exchanger in the manufacture of radiators for automobiles, trucks, military tanks or Diesel engines. Production of such radiators might be warranted if the present critical copper shortage grows even more critical or if demand becomes high for the lightest possible weights.

The Brazed Joints

Big production problem in fabricating the brazed heat-transfer units was to bring the temperature of the complex core assemblies to the melting point of the brazing material without reaching the melting point of the pure aluminum. The special duplex sheet consists of a core of pure aluminum (such as type 3S) with a coating of brazing material on either one or both sides. The brazing material is about 92½% aluminum and 7½% silicon. The silicon lowers the melting point of the coating material to about 100 F below that of the pure aluminum. Therefore, the coating flows and makes the joint before the assembled parts lose their rigidity.

As the joint is practically all aluminum, it is at least as strong as the parent metal. The fillets will usually make the joint stronger than the core material. Available information indicates that corrosion resistance is no less than that of a welded joint.



1—STEEL SKELETON goes up for Robinson's Beverly Hills store, an important landmark for welded construction

All-Welded Framework

Horizontal and vertical continuities of both girders and columns are provided by a welded design estimated to have saved about 15% in steel tonnage.

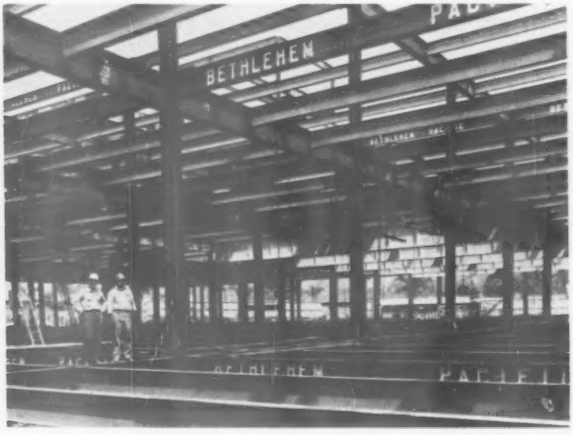
BY FRED M. BURT

THE new four-story department store building to house the Beverly Hills branch of J. W. Robinson Co., Los Angeles, has a structural steel skeleton that is all welded except for a small percentage of steel. It is one of the relatively few large welded structures to be erected in California.

Some buildings to be found in the Los Angeles area are partly welded, partly riveted. An example is the Southern California Edison Co. building, which employed welding for lateral forces and riveting for vertical stresses. Constructed in 1929 by P. J. Walker Co., the Edison building represented the first major application of arc welding to building construction in Southern California.

Known as "Robinson's Beverly," the new department store will have a two-level parking area capable of

3—COLUMN appears to run right through girder and girder to go through the column



4—GIRDERS and columns as seen from the main floor. In right background are the five 64-ft double-span riveted plate girders

2—FINISHED STORE is pictured in the above architects' drawing. Note the clean, modern lines of the building

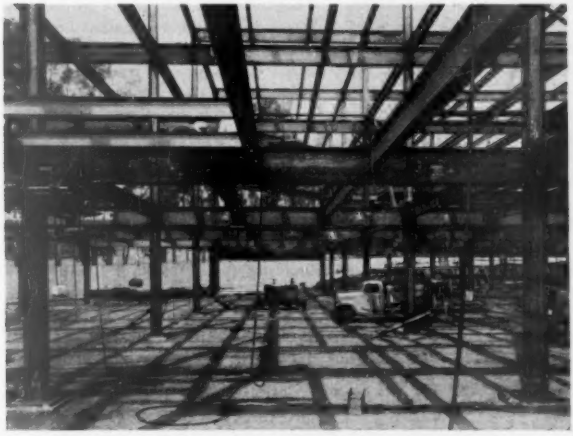
in New Department Store

accommodating 1,100 cars. Inside there are 244,000 sq ft of floor area, with provision for expansion of the fourth floor to achieve a possible 285,000 sq ft. The store is located on a 7.6-acre tract and faces Sunset Boulevard.

Walls will be finished in white marble, black granite and architectural concrete to emphasize the clean, modern lines of the new building. Wire mesh wrapping with the exterior layer of concrete provides maximum fireproofing. To sum it all up, it's a beautiful building, and one of which architects W. L. Pereira and Charles O. Matcham can well be proud. Fig. 1 shows the skeleton in process of erection, and Fig. 2 (architects' drawing) how the building looks completed.

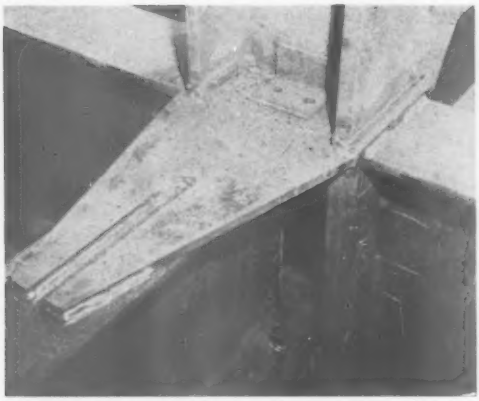
The prime contractor was the William Simpson Construction Co., of Los Angeles. Page L. Edwards was project manager for the contractor, and Max Horwitz project manager for the architects. But the key men insofar as designing and detailing the structural steel erection were concerned were structural engineers Paul E. Jeffers and Robert Wilder.

Before the type of construction was decided upon, Jeffers and Wilder, acting for the prime contractor, designed eight different schemes of framing a typical bay (of 1,024 sq ft) bounded by four columns. These plans were

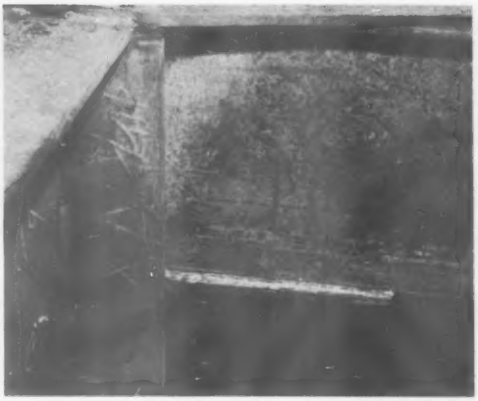


5—PROJECTING ENDS of 45-ft-long main girders are spliced to 17-ft lengths of girders. Splices are at the points of least stress

6—SPLICE of main girder is at right, intermediate girder connection toward the left



7—TYPICAL JOINT of column with main and intermediate girders. Note slot for weld bead in top plate



8—MAIN GIRDER is at left; transverse girder runs into column from right and is continued on other side

turned over to the contractor to estimate comparative costs. On a cost basis, all but three proposals were eliminated, two of which were welded and one riveted. Finally, one of the welded designs was chosen.

Saved 15% in Steel

The selected scheme of vertical and horizontal welded continuity enabled the use of girders of smaller section. This resulted in shorter distances between the ceiling of one floor and the floor level above. The saving of about 6 in. in height per story saved steel estimated to run about 15% on a typical bay, without any lessening of the strength of the structure as compared to the riveted designs.

Jeffers and his associate Wilder have attained major prominence in the engineering of all-welded structures, having made exhaustive studies of stresses and the other factors involved in welded framing. The first all-welded buildings of appreciable size in the Los Angeles area—telephone company exchange built in the middle '30's—were Jeffers structural engineering jobs. The new addition to the Lincoln Heights jail and the "Bishop Stevens" wing of the Good Samaritan Hospital are more recent all-welded jobs for which Paul Jeffers served as structural engineer.

The steel for Robinson's Beverly was fabricated in the Los Angeles plant of the Bethlehem Pacific Coast Steel Corp. and erected by the same concern's erection department. Approximately 1,700 tons of structural steel were required, most of which was field welded to specifications. To do the welding took about eight tons of welding electrodes—AWS classifications E-6010 and E-6012 in diameters of 5/32, 3/16 and ¼ in. Seventeen d-c arc welders, mostly 300 amp, were used by the 16 certified weldors who did the field welding.

The weldors who worked on this job were all members of Structural Iron Workers Local 433, AFL. The field force followed the carefully selected Bethlehem Pacific welding procedures, working in close conjunction with Bert Kolburn, of Robert W. Hunt Co. (engineers), who represented the owners for welding inspection.

Welding Foreman Gerald L. Glenn supervised the welding crew. Other Bethlehem Pacific Steel erection personnel included structural iron workers and apprentices for steel erection and a welding equipment maintenance engineer to keep arc welders in top working condition. All erection work was under the supervision of Jack Hamilton, Bethlehem's erection superintendent.

Let's now take a look at some of the details. Figure 3 shows a Bethlehem designed and built weldor's platform that is easily portable and quickly suspended. Steel angles were welded together at the corners to make a rectangular frame to hold a floor of ¾-in. plywood. This picture is also a good example of how the vertical and horizontal continuities of column, main girder and transverse girder are maintained by welded erection. Note particularly the crossing between the column and the main (upper) girder.

In Fig. 4 we go down to the first-floor level. The two men standing on the girder are Jack Hamilton, erection foreman, and Gerald Glenn, welding foreman. In the right background may be seen the five double-span riveted plate girders above the main concourse. We'll tell more about these 64-ft girders later on.

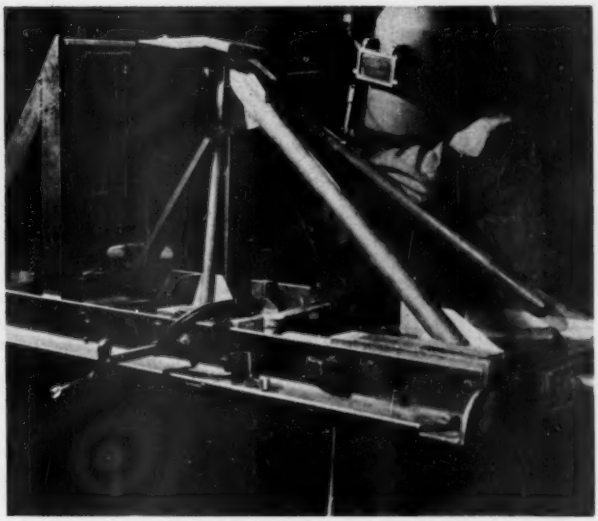
Columns and Girders

The columns that carry the building weight are 14 by 12½ in. I-beams weighing 161 lb per ft. Lighter columns are used in the upper floors, but vertical continuity is maintained as surely as though single, unbroken columns ran all the way from bottom to top. By spacing the columns 32 ft apart between centers, column-free areas of nearly 1,024 sq ft are provided, the largest in any of the Southern California department stores.

The main girders are primarily 27-in. wide-flange beams weighing approximately 102 lb per ft. The 47-ft lengths are so welded that the continuity of a single girder is maintained for the full 320-ft length of the building (on three levels). Each 47-ft girder spans from one column to the next and projects approximately 7 ft 6 in. beyond each column. (To get the latter figure, subtract the 32-ft column spacing from the 47-ft girder length and divide the difference by two.) When a line of girders was thus erected, there was left a

(Continued on page 41)

TITANIUM and most of its alloys can be welded with the resistance processes



HIGH OXIDATION means trouble in fusion welding. However, titanium can be satisfactorily welded by means of the inert-arc process

Titanium Is Weldable

Here's the latest on what's been learned about welding the "wonder metal" titanium. You can weld titanium to titanium but don't try to weld it to other metals—yet.

BY THOMAS A. DICKINSON

TITANIUM, current "wonder metal" of the aircraft industry, has long been well known to chemists and metallurgists as the fourth most abundant structural element in the crust of the earth. In spite of this, the cost ranged upward from about $20 per pound. Obviously, titanium could be used only as a minor constituent of ferrous and non-ferrous alloys.

Thanks to aircraft production requirements, which have necessitated the use of improved titanate ore processing methods, the cost of pure titanium is being rapidly reduced. Eventually, it should reach a level that will be well within the budgetary limitations of virtually all fabricators of metal products.

Its Good Properties

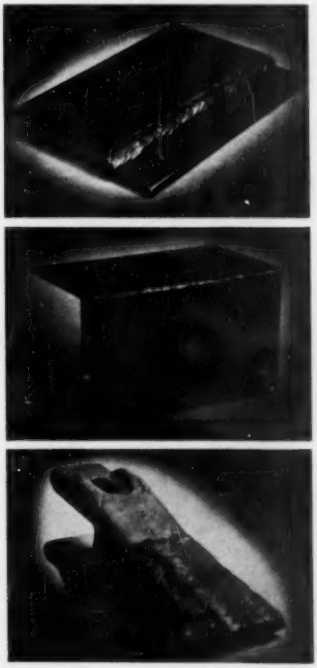
This is a matter of particular significance to the welding engineer, because titanium is certain to find many applications by virtue of its properties, which include:

(*a*) Oxidation resistance comparable to that of platinum; better than that of stainless steels, cupro-nickel

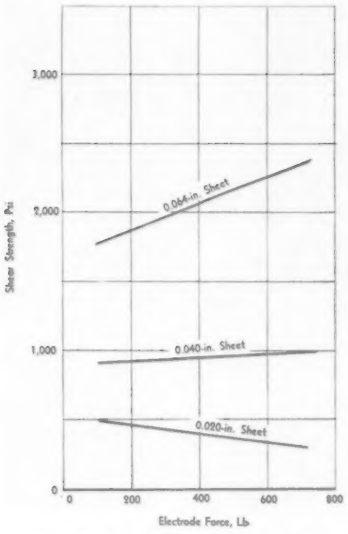
Table I. Spot Welding 0.068-in. Carbon-Titanium Sheets

Weld Current, Amp	*Weld Diam, In.*	*Heat Zone, In.*	*Penetration, Per Cent*	*Strength, Psi*
8,000	0.266	0.290	77	2,700
9,000	0.285	0.300	82	2,900
10,000	0.310	0.335	90	3,400

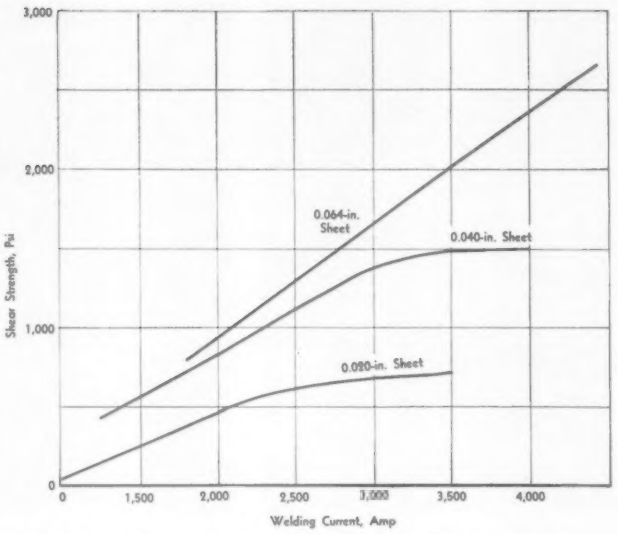
Data above obtained on a synchronously controlled 100-kva spot welder, using a 10-cycle welding interval, 1,000-lb electrode force, and RWMA Class 2 electrodes having 3-in. tip radii.



JOINTS produced are essentially the same as other welded joints



EFFECT of electrode force on welds



HOW CURRENT can vary the shear strength of welded titanium sheets

alloys, etc., in the presence of corrosive chemical solutions.

(*b*) Almost as low a weight as aluminum, yet with a better strength-weight ratio than most types of steel.

(*c*) Generally good fabricating characteristics.

(*d*) Surface hardenability. This is important when it is required to make parts with extreme resistance to wear or abrasion.

(*e*) Compatability with many other elements where special-purpose alloys are required.

Let us now look at some of the ways in which titanium can be welded. The first method is resistance welding.

Pure titanium can be readily welded with resistance equipment. It is, for instance, adaptable to a greater range of spot-welding conditions than stainless steels without difficulties due to electrode sticking. The three graphs reproduced herewith show the effects of electrode force, welding current and time upon the shear strength of welded titanium sheet stock. It should be noted that the 1/8-in. diameter electrodes that did the spot welding were somewhat small on the basis of current AWS recommendations.

Little success can be anticipated in welding pure titanium with oxyacetylene equipment, according to engineers at North American Aviation, Inc. Though titanium has a melting point of 3,140 F, it will oxidize readily at temperatures exceeding 800 F. Ordinary arc welding is also not practicable. However, titanium has been successfully joined by the inert-arc welding process. It has also been brazed with good results in cases where it was possible to use brazing furnaces, nickel-solder materials and an inert-gas atmosphere.

Table II. Mechanical Properties of Titanium and Titanium Alloys

UNALLOYED TITANIUM

Property	*Annealed Condition*	*Half Hard Condition*	*Fully Hard Condition*
Ult. tensile strength, psi	80,000	115,000	1 5,000
Yield strength, psi (0.2% offset)	72,000	105,000	110,000
Elongation, % per 2 in.	25	14	12
Ult. strength/density x 10^3			
At room temperature	488	701	763
At 1,000 F	100	140	122

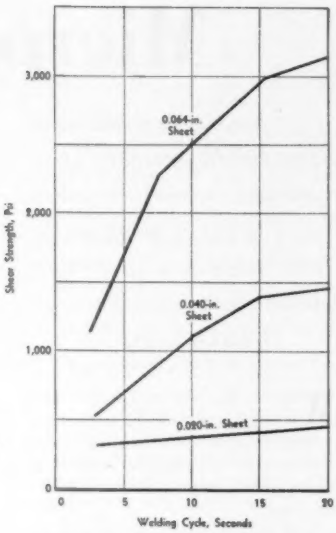
TITANIUM ALLOYS

Alloy	*Condition*	*Tensile Strength, Psi*	*Yield Strength, Psi*	*Elongation, % per in.*	*Hardness*
Tungsten-carbon	As forged	131,000	119,000	21.5	27 R.C.
Aluminum	As forged	113,600	.....	11.0	66 R.A.
Manganese-aluminum	As forged	158,000	106,000	1.5	.....
Chromium-tungsten	Normalized	149,500	.....	.....	51 R.A.
Chromium-molybdenum	Hot rolled	175,000	.....	4.5	367
Chromium-nickel	Hot rolled	194,700	.....	3.0	417

Titanium Alloys

Titanium alloys in various circumstances have the advantages and/or disadvantages of pure titanium from the weldor's point of view. For instance, engineers at P. R. Mallory Company have disclosed that relatively high welding currents and pressures are needed for satisfactory spot welding of 0.068-in. cold-rolled sheets of carbon-titanium alloys (Table I).

Alloys of titanium with aluminum-chromium or aluminum-iron are probably the most weldable titanium materials, since they may have high oxidation resistance at elevated temperatures as well as good mechanical properties. However, titanium-boron alloys are preferable where considerable ductility is desirable; and various quantities of chromium, molyb-



TIME also affects shear strength

denum, manganese and iron have been used to produce alloys that are simultaneously quite weldable and adaptable to many specialized applications.

Stresses due to the welding or fabrication of titanium and most titanium alloys can be relieved by heating the weldment in air for about an hour at temperatures up to about 600 F.

Where surface hardening is necessary, titanium and titanium alloys may be oxidized, nitrided, etc., the same as more conventional types of industrial alloys.

Dissimilar Metals

Technical men at Boeing Aircraft Co. say it is particularly difficult to weld pure titanium to dissimilar materials because of inadequate fusion. For example, efforts to spot weld titanium to Everdur, Monel and nickel alloys have resulted in nothing more than coarse mixtures of the respective metals; and attempts to fuse titanium to stainless or low-carbon steels have usually produced extremely brittle weld nuggets. However, it it believed that specialized welding techniques—such as the pulsation-welding process—will eventually solve many of the problems associated with the fusion of titanium and dissimilar metals.

ALL-WELDED FRAMEWORK

(Continued from page 38)

17-ft gap between each pair of 47-ft girders. To make the continuous beam, girders 17 ft long were spliced between the projecting ends, as shown in Fig. 5. Care was taken to locate the splices at, or very close to, the points of minimum stress.

One very great advantage of this type of construction is the flexibility it adds to erection. Normal slight variation in the lengths of horizontal girders caused some variations in the gaps between the main and splice girder ends. However, the splice took care of them without extra effort. This adds up to an important item of time-and-money saving when the number of splices involved is taken into consideration.

The detail of a typical splice is shown in Fig. 6 (at right). The flange splice plates are shop riveted to the girder ends and then field welded to the connecting girder. Note how the riveted and the welded sides are alternated at top and bottom: the riveting is on the left at the top flange and on the right at the bottom flange. The web splice plate, though welded, is bolted in place for shipment to the job.

Intermediate girders are erected at right angles to the main girders. The smaller transverse girders, 32 ft long, are spaced 10 ft 8 in. apart (center to center). They are primarily 18-in. wide-flange beams weighing 50 to 55 lb per ft. Details of the connection to the 27-in. main girder are illustrated at the center of Fig. 6. The welded top splice plate maintains top continuity. The shear connection angle below was shop riveted to the intermediate beam and then welded to the main girder. At bottom, a shop-riveted compression plate rests on a clip angle. The clip angle was shop bolted to the web of the 27-in. girder for shipment and then field welded.

Welded Continuities

At each column joint, arc welding provides both vertical and horizontal continuities. Let's look at Fig. 7, a typical column joint. The vertical stiffeners are shop welded to the girder ends to continue the flanges of the column. The top continuity plate is welded across both girder and column; note the slot provided for extra weld beads.

Figure 8 is a view of a column joint from another angle; the main (27-in.) girder is at the left and an intermediate (18-in.) girder runs into the column from the right. An extension of the intermediate girder is welded to the opposite side of the column so that this girder has a continuity comparable to that of a beam running straight through the joint.

With the welded joints illustrated in Figs. 7 and 8, there is no structural strength difference to be considered in either vertical or horizontal continuities, even though the main girders run through the joint unbroken while the columns and intermediate girders must have their continuations added by welding.

The results could be just as satisfactory structurally if it were the other way around; that is, if the main girders had the welded continuities, and the columns ran through the joints unbroken. It is obvious, however how much easier the method employed makes it for the men doing the erecting. The main girders need only to be laid on top of rigidly placed columns and then lined up preparatory to welding. If the columns ran straight through, how much more difficult it would be to hold up the girders on either side!

Riveted Plate Girders

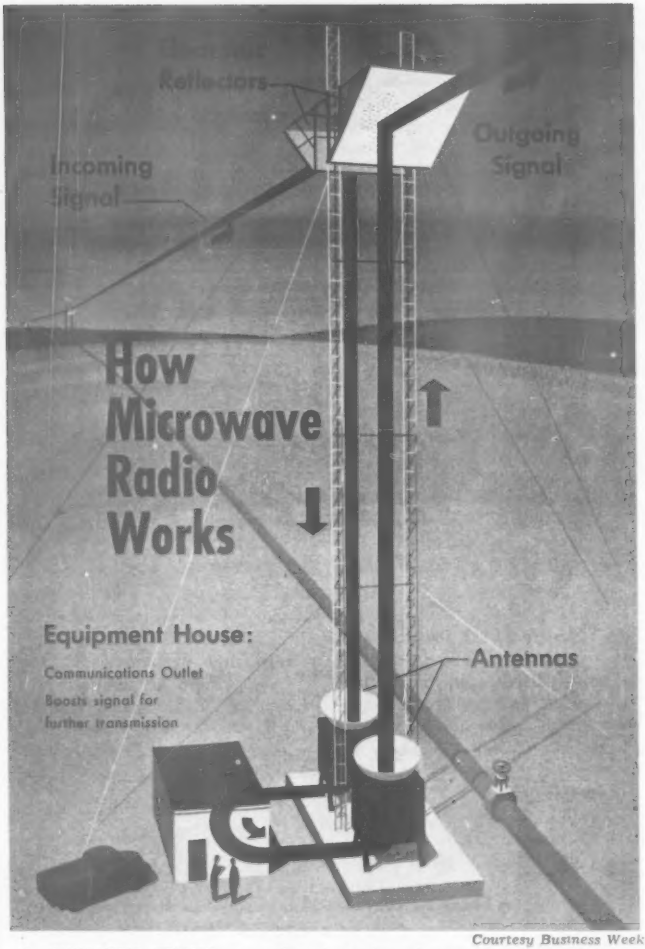
Let's now return to the five riveted plate girders that we noted previously in Fig. 4. Each of these 22-ton jobs is 64 ft long, providing a double span that eliminates a supporting column. The five girders thus eliminate five columns, allowing a column-free main concourse 63 feet wide by 191 ft long in front of the main entrance. The columns eliminated on the ground floor are run upward from the plate girders, which support them to the top of the building.

These plate girders were riveted rather than welded because of shop practices and shop layout in Bethlehem's fabricating department. To weld them would have required a special shop set-up, which, it was believed, was not warranted by the particular job. For the same reason, the fabricator (Bethlehem) was also given permission to do such other shop riveting as the attachment of framing angles and splice plates.

Micro

Newest development in communications requires giant aluminum screens to reflect incoming and outgoing waves. Their fabrication is another job for inert-arc welding.

BY SAM KAPLAN
Pioneer Iron Works, Sioux City, Ia.



Courtesy Business Week

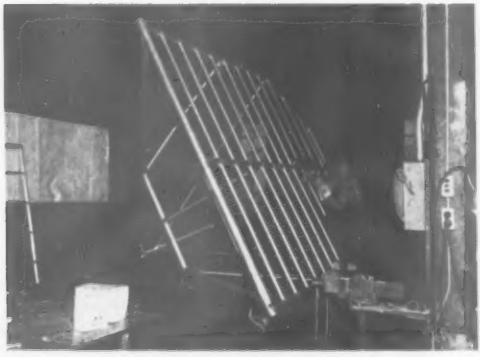
1—INCOMING WAVES are reflected to the relay or repeater station at the tower house. Outgoing waves are reflected from tower to next station

WHEN you were a boy, did you ever signal your chum in the neighborhood by reflecting the light of a sunbeam into his window with a pocket mirror or a bit of broken looking glass?

Well, this old and incomplete communication system has grown up until today, by using the same old boyish principle of reflection, a new and marvelous type of communications has been perfected. But instead of the sun's rays, the signals are microwave radio waves. Instead of pocket mirrors, giant aluminum reflectors are used. And whereas the boy's communication system was inoperative on a cloudy day and at night, the new system operates 24 hours a day over distances of hundreds of miles.

This newest development in communications is called the microwave radio relay.

The Bell System has many miles of non-automatic microwave relays for long-distance telephone and telegraph messages. Bell also has a short in-



3—FRAMEWORK for reflector at a late stage. Weldor is completing welds on center support member of face

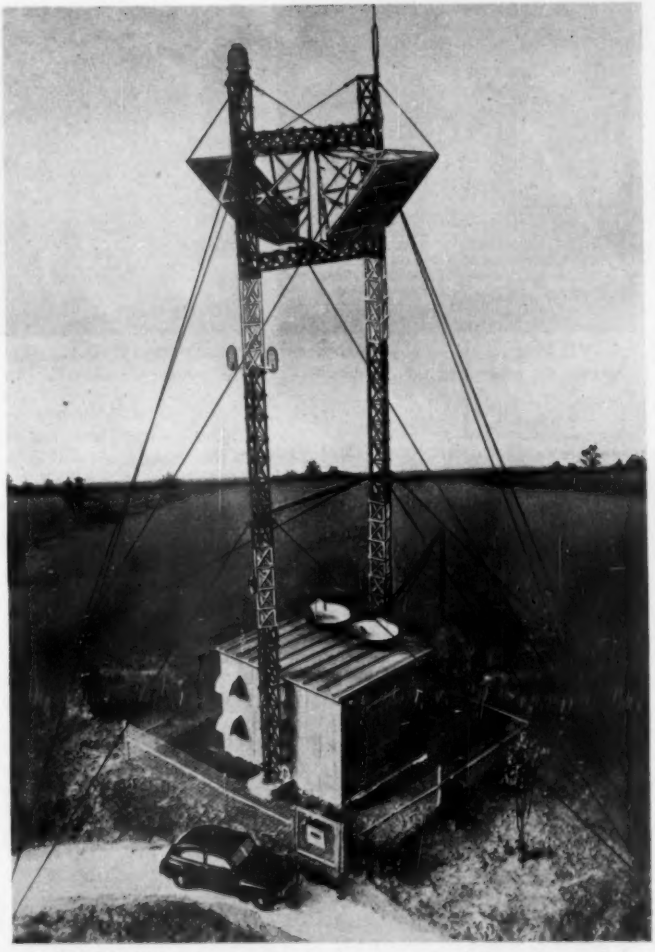
4—MAKING an angle cut on a 2½-in. aluminum tube that will form a section of the reflector's framework

wave—

stallation of the latest automatic microwave radio relay on its New York-Boston television system. In addition to the development of automatic relays for television transmission, a great deal of development work is being done in the fields of telephone, telegraph and pipe lines. It is in the pipe-line field, particularly, that the automatic form of microwave radio relay has reached the highest form of development to date. Whereas six years ago the mileage was almost zero, there are today over 15,000 miles of point-to-point microwave networks being operated by utilities and pipe lines (*Business Week*, July 28, 1951).

A Boon for Pipe Lines

For years a pipe-line problem of prime concern has been the maintenance of immediate and continuous communications between all terminal points and major pumping stations. This is imperative to insure complete control of the liquids being transported. To insure safety and economy of operation, the status of the entire flow-volume, pressure, delivery rate, etc., must be definitely known and closely coördinated from central points. Any desired changes in flow must be instigated almost simultaneously from many points. It is therefore evident that the communication system must be not only adequate and reliable but virtually uninterruptible.



2—MICROWAVE relay station, showing the two reflectors at top of the tower, blockhouse at base and the two parabolic dishes on blockhouse roof

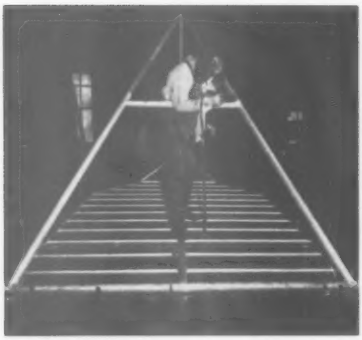
5—WELDING 1½-in. members into 2½-in. OD center member of face

In the past, the actual means fell far short of the ideal. Advent of the microwave communications system was, therefore, of prime importance to the pipe-line industry.

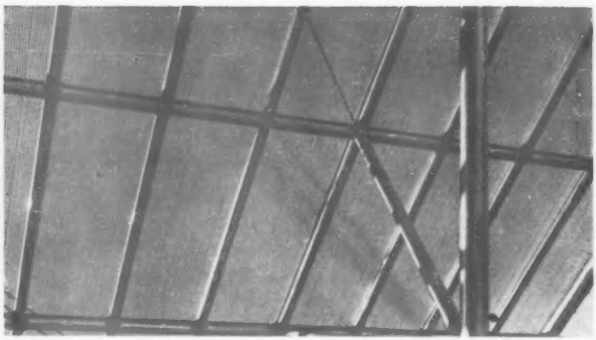
Microwaves enable the attainment, for the first time, of a system that meets pipe-line requirements. Microwave installations offer an integrated system of telephone, teletype, telemetering and vocal messages. Capital investment and maintenance costs are much lower than with pole-and-wire set-ups. Without wires, the microwave signal can accommodate up to 24 separate and simultaneous circuits—the equivalent of 24 individual telephone lines.

How It Works

The basic principles of microwave radio are depicted in the accompanying sketch (Fig. 1). A microwave system consists of relay stations, which are made up of a relay tower, reflectors and repeater stations. Since the distance between relay points is limited by the earth's curvature, stations cannot be much more than 30 miles apart—about as far as the eye can see. Station sites are established at the highest points possible, and large cities, bodies of water and other



6—WELDOR stands on face framework to weld the supporting tubular members



7—PERFORATED aluminum screen has been attached to the face of the tubular framework. This completes fabrication of the reflector

physical obstructions are avoided as they tend to deflect the signal upward, causing a part of it to be lost.

Relay Station Reflectors

At each relay station is a reflector tower from 100 to 250 feet high, which supports a double microwave reflecting screen. Microwaves, like light waves, travel in a straight line. When they strike the receiving aluminum reflecting screen, they are deflected to the TR (transmitting-receiving) blockhouse at the base of the tower. An automatic transmitting and amplifying mechanism re-transmits the beam through the antenna of the second TR unit to the outgoing reflector above. And the beam is on its way again to the next relay station, where all steps are repeated. This process continues until the beam (and the signals impressed on it) arrive at either the terminal point or a desired intermediate station.

Engineers summarize the basic operating principles of a microwave operating system in this manner:

"The tower is a two-way repeater station. The flat reflectors at the top pick up the aimed microwaves and deflect them to the transmitting and receiving unit at the base of the tower. In sending messages, the opposite takes place; the TR unit at the base projects the wave beam up to the reflector. At the pump stations, the microwaves coming in are reduced by converters to the lower frequencies used by regular voice and teletype frequencies."

Formerly, the parabolic dishes (shown on top of the blockhouse in Fig. 2) were mounted on top of the tower. This necessitated a coaxial cable from the blockhouse running the length of the tower. Coaxial cable is expensive, is vulnerable to air leaks and needs to be pressurized. It was highly desirable to find a way to eliminate both the costly coaxial cable and its high upkeep.

To meet this requirement, there was designed a passive reflector fabricated completely of aluminum. This design met all optimum requirements for strength, economy, lightness and ease of alignment and adjustment. The low moment-of-inertia of the aluminum tubing resulted in greater stability and the use of tubing made the structure aerodynamically sound. (This reflector is stressed for wind loads of 100 mph.)

Fabricating the Framework

Framework of this important link in microwave transmission was fabricated entirely of 61ST6 aluminum tubing, 2½ in. and 1½ in. OD. Wherever possible, the joints of either similar or dissimilar sized tubing were prepared by properly beveling the tubing with metal-cutting band saws and/or special tube-cutting dies. Joints that could not be made in this manner were developed from an original mock-up of the design and finished by manual processes.

Here is how a reflector screen was made at the Pioneer Iron Works:

First the face of the reflector was fabricated (Fig. 3). The 2½-in. members that frame the face were fitted by straight angle saw cuts (Fig. 4) and welded by the inert-arc process, using a 5% silicon-aluminum rod and a current setting of 140 amp. The center member of the face, a 2½-in. tube with ends die cut to form a perfect saddle joint, was also welded in place.

When the frame of 2½-in. tubing had been completely welded, the face was ready for the insertion of the 1½-in. tubular members (Fig. 5). These were inert-arc welded to the frame in such a manner as to insure a perfectly flat face. Maximum deviation allowed on the face is ± 0.0625 in. Current was lower—130 amp.

When the face framework was completed, the main 2½-in. structural members were positioned by a helper and welded in place (Fig. 6). To complete the framework as shown in Fig. 3, the remaining braces for "T" and "V" bracing were then installed. Some reflectors required a special mounting, which was fabricated from 61ST6 aluminum plate. A rib ⅜ by 1 in. was welded to the plate, and this assembly was then welded to the reflector.

Screen Added Last

The last step in fabrication was to attach a perforated aluminum sheet (Fig. 7) to complete the face of the reflector. This sheet (screen) is of 0.40-in. 3S aluminum sheet having ¼-in. perforations spaced at ⅜-in. centers. The screen was securely stretched and clamped, and then bolts were used to secure it to the framework.

Two reflector screens are mounted at the top of the reflector tower, as shown in Fig. 2. Those fabricated at Pioneer Iron Works were installed by the Tower Construction Co., Sioux City, Ia., for an oil pipe-line company.

What You Should Know about Welding

Ductile Iron

Figures 1 and 2 show the transformation from gray iron to ductile iron by the addition of magnesium to the heat of regular gray iron. What results is a change of graphite form—from flakes (Fig. 1) to spheroids.

BY W. C. MEARNS

Metallurgist in charge of Atlantic Coast Technical Section, Development and Research Div., International Nickel Co., Inc.

Ductile iron was first described at a meeting of the American Foundrymen's Association in May, 1948. Since then approximately 100 foundries have been licensed to produce this new engineering material, said to combine all the good qualities of cast iron and cast steel. Ductile iron can also be readily welded. Here, in the first published account of how to weld this new material, the author gives recommendations applying to all forms. He also describes in detail the results of experimental installations of arc-welded centrifugally cast ductile iron pipe.—THE EDITORS.

DUCTILE iron is cast iron. However, the traditionally brittle properties of cast iron have been markedly improved by a relatively simple change in its internal structure. Figures 1 and 2 show why very clearly. The dark areas represent graphite (somewhat similar to the "lead" in the pencil you write with), which is always present in gray cast iron. If the graphite is long, snaky or "flaky" and is connected together like stringers (Fig. 1), the iron is weaker than when the graphite is present as rounded masses or "nodules" (Fig. 2). That is basically why ductile iron (also known as "spheroidal" or "nodular" iron) has high tensile strength and can be bent appreciably like steel before fracturing. In addition, it has good fluidity, good casting properties and, particularly important, retains the excellent corrosion resistance of gray iron.

Actually, ductile iron is not just one iron, it is a whole group of ferrous materials characterized by the graphite in the form of spheroids. This type of grain structure is the result of small but effective additions of magnesium made to the iron at the time of melting. The presence of spheroidal instead of flake graphite is largely responsible for the excellent ductility that results after annealing.

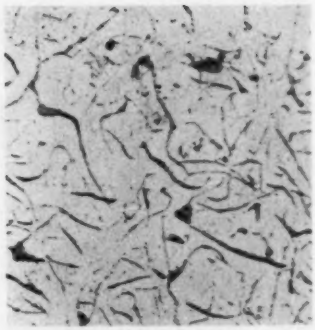
Four important types of ductile iron are now being produced commercially. Representative mechanical properties of commercial heats are:

Type A. Tensile strength: 95,000 to 105,000 psi; yield strength: 70,000 to 75,000 psi; elongation: 2.5 to 5.5%; Brinell hardness: 225 to 265. Usual condition: as cast. Pearlitic in structure. Provides good mechanical wear resistance.

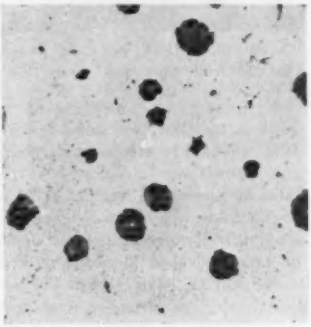
Type B. Tensile strength: 85,000 to 95,000 psi; yield strength: 65,000 to 70,000 psi; elongation: 5.5 to 10.0%; Brinell hardness: 195 to 225. Usual condition: as cast. Pearlitic-ferritic in structure. Provides strength and toughness combined.

Type C. Tensile strength: 65,000 to 75,000 psi; yield strength: 50,000 to 60,000 psi; elongation: 17.0 to 23.0%; Brinell hardness: 140 to 180. Usual condition: annealed. A fully ferritic structure usually obtained by short anneal or either A or B. Provides optimum machinability and maximum toughness.

Type D. Tensile strength: 85,000 to 95,000 psi; yield strength: 65,000 to 75,000 psi; elongation: 1.0 to 3.0%; Brinell hardness: 230 to 290. Usual condition: as cast. Higher phosphorous content than preceding grades, also higher manganese. Provides high strength and stiffness but only moderate impact strength.



1—GRAY IRON has a flaky looking graphite structure as melted and cast. Magnification 100X



2—DUCTILE IRON has a nodular or spheroidal graphite as melted, processed and cast. 100X

Always of interest to engineers are the actual tensile strengths of pipe walls. Regular iron pipe in 6-in., 8-in. and 12-in. sizes develops wall tensile strengths of 26,000 to 33,000 psi with no elongation. Ductile iron pipe in the same sizes shows 70,000 to 94,000 psi tensile strength with elongation values of 2½ to 8%.

Particularly important to municipal engineers is the ability of pipe to resist bursting under water pressure. Figure 3 shows a ductile iron pipe subjected to internally applied hydrostatic pressure until the bursting strength was established—at 4,300 psi. The bursting occurred through the wall and not at the weld. The wall didn't shatter but actually bulged before breaking, as would probably happen with steel.

WELDING DETAILS

A number of pipe lengths were arc welded without difficulty, using an

3—WALL BROKE, not weld, when ductile iron pipe was given test

electrode of 60% Ni-40% Fe composition and d-c reverse polarity. Current settings were: 95 amp for a ⅛-in. electrode, 115 amp for a 5/32-in. electrode. The joints were prepared with an 80-deg included angle having a 1/16 to 1/32-in. square land at the root. Casting "skin" was removed to ½ in. from the weld area (face and root).

No preheat was used. In cold weather it was necessary to warm the joint area to approximately 250 F.

A ⅛-in. electrode was used for tack welding and to deposit the first layer of positioned welds. A 5/32-in. electrode was employed for tack welding and for all weld layers on pipes rolled to permit welding in the flat position.

When welding the 8-in. ductile iron pipe with a wall thickness of approximately ⅜ in., three passes were made to complete the joint. The joints were first tack welded with four equally spaced tack welds 1 in. long. For the first and second passes, an intermittent sequence was used to equalize stress and properly distribute heat input. The third pass was a continuous weld.

Bursting tests of ductile iron pipe welded by this procedure and comparative tests on standard full lengths of pipe indicate that bursting and tensile strengths are of the same order. In no instance did failure occur in the welded zone. Table I gives the bursting pressure (psi) and tensile strengths for full-length bursting tests on centrifugally cast ductile iron pipe in 6, 8 and 12-in. diameters and lengths of 15 ft 6 in. The six lines marked by an asterisk represent two 7 ft 9-in. lengths arc welded together.

To study machinability, the ductile iron pipe was welded after the regular foundry process anneal, using a 600 F preheat. The same electrode was employed. After pressure testing, shaper cuts were taken across the pipe surface. As Fig 4 shows, the shaper cut across the weld area with ease.

The use of a ferritizing anneal before welding was found to improve machinability in the heat-affected zone, whereas the use of a 600 F preheat appeared to be somewhat damaging. Postheating at 900 F largely eliminates the hard zone; full annealing after welding produces machinability comparable to that of the unwelded ferritized plate.

How to Weld Ductile Iron

The 60% nickel, 40% iron electrode appears to be the most suitable of those tried to date. The casting should be prepared by cleaning off oil, grease or other foreign material, and the casting "skin" should be removed by grinding or other suitable means.

If maximum strength and ductility are desired after welding, it is preferable to use fully annealed ductile iron; however, this is not always necessary. The hazard of cracking along the fusion line is decreased by preheating the ductile iron to about 600 F prior to welding. Ductile iron of low manganese and low nickel content is less inclined to fusion-line cracking and possesses better machinability adjacent to the welds than more highly alloyed irons.

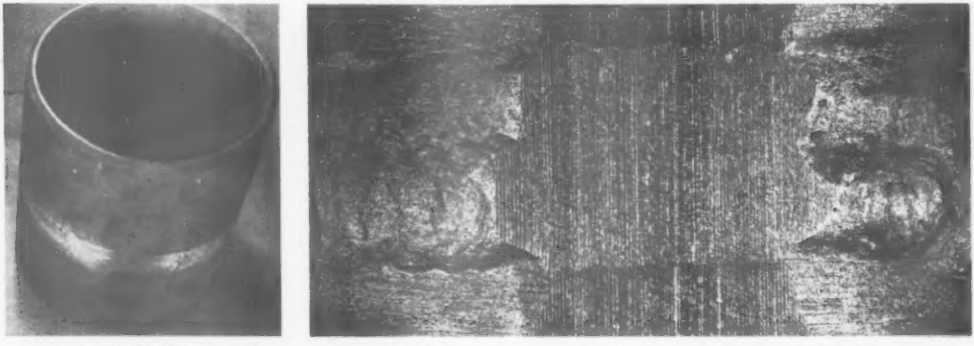
Welding current should be as low as possible, consistent with smooth operation, good bead contour and good "wash." For welding in the flat position, the following ranges of welding current are generally satisfactory for the following electrode diameters:

3/32-in.—60-70 amp
⅛-in.—90-100 amp
5/32-in.—120-130 amp
3/16-in.—140-150 amp

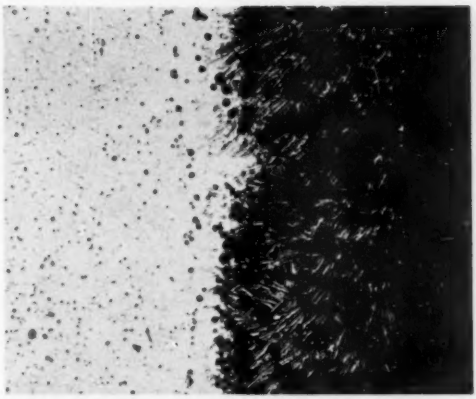
When a high preheat is used or out-of-position welding is involved, these values should be adjusted downward. Section thickness of the casting must also be considered a factor.

Minimize Heat Input

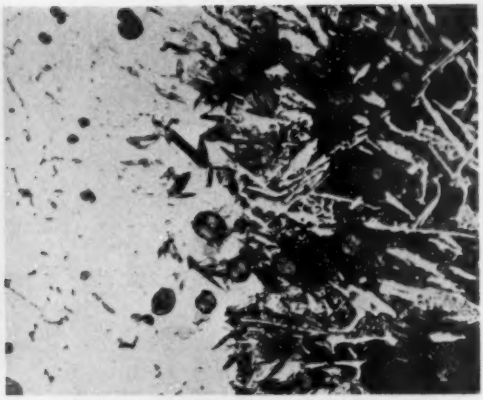
Avoid concentrating the welding in one area. An intermittent bead method is preferred to distribute the heat over the entire area. Sometimes it is helpful to "butter" the surface before laying in the passes. Casting preheated to 600 F should be welded at such a rate that the temperature of the repair area remains at about



4—MACHINABILITY test: shaper cuts were taken across the welded area. It is obvious machining is satisfactory



5—CARBIDE FLASH along the line of fusion. Parent metal at right, weld metal on left. Magnified 100X



6—HIGHER MAGNIFICATION (500X) shows that the fusion zone carries considerable spheroidal graphite

600 F. When preheating is not practiced, the heat input should be kept to a minimum by depositing relatively short beads so that the casting remains only somewhat warm to the hand. In no case should castings be welded as cold as they might get during the winter.

If peening is done to decrease the internal tensile stresses in the welded joint, use a round-nosed tool. Take care to avoid excessive peening since this may lead to localized ruptures.

Don't let castings cool rapidly after welding; cover them with asbestos cloth or other insulating material. Still air is satisfactory, however, where stresses are not likely to be high, as in small repairs or in small castings.

The low ductility commonly encountered in as-welded joints may be ascribed to carbide flash and a brittle martensitic zone adjacent to the weld. A ferritizing or annealing heat treatment after welding removes this zone. Also damaging to ductility is the rejection of graphite in closely spaced small, round particles along with occasional small flakes.

A limited metallographic examination of an as-welded joint showed a rather pronounced carbide flash at the base-metal edge of the fusion zone. The photomicrographs Figs. 5 and 6 were made by the Lynchburg Foundry Co. of a specimen taken from the fusion zone of ductile iron pipe welded with the previously mentioned 60% Ni-40% Fe electrode. The details were brought out by etching the specimen with 2% nitric acid in alcohol.

In Fig. 5, a magnification of 100X, the weld metal is the light area toward the left; the parent metal the darker area toward the right. The carbide flash may be seen along the junction line between weld and base metal. This joint was made without preheat or postheat treatment.

Figure 6, the structure at high magnification (500 X), shows that the fusion zone carries considerable graphite as spheroids. To increase the ductility and machinability of this structure, use an anneal-heat treatment.

The best tensile test results, it is discovered, can be obtained by using annealed ductile iron, preheating to 600 F, welding and referritizing after welding by furnace cooling from 1,675 F and tempering at 1,275 F. In this instance, one weldment yielded a tensile strength of about 64,000 psi with about 6% elongation in 2 in., which means about 12 to 15% elongation in the weld itself.

* * *

The author takes pleasure in acknowledging the coöperation of Max Kuniansky, vice-president and general manager of the Lynchburg Foundry Co., and that of W. W. Levi and Lewis Graham, of the same company, who prepared the test specimens, photomicrographs and data for this article.

Table I. Bursting Tests of 15 ft 6 in. Pipe Lengths

Size (Diam., In.)	*Class, Lb*	*Thickness, In.*	*Bursting Pressure, Psi*	*Bursting Tensile Strength, Psi*	*Size (Diam., In.)*	*Class, Lb*	*Thickness, In.*	*Bursting Pressure, Psi*	*Bursting Tensile Strength, Psi*
6	light	0.249	4,600	58,900	8	150	0.365	4,300	48,600
*6	light	0.235	4,050	54,500	*8	150	0.417	4,850	47,250
6	150	0.379	7,300	57 000					
*6	150	0.362	6,250	52,400	12	light	0.288	2,350	50,750
					*12	light	0.318	2,650	51,900
8	light	0.267	3,500	55,750	12	150	0.456	4,150	54,600
*8	light	0.280	3,700	55,400	*12	150	0.457	3,875	52,000

*Two 7 ft 9 in. lengths are welded into the standard 15 ft 6 in. length

2—SKELP ENTERS the forming mill at the pinch roll. Before it enters the forming stands, it is taken through an edge conditioner

3—U-SHAPED skelp emerges from the last of the four stands of U-ing rolls

1—LOOKING DOWN the production line at the Kaiser Fontana pipe mill; control panel for the big seam-welding unit may be seen at right center

Straight--

Forming, welding and sizing pipe 5 9/16 to 14 in. is a straight-line operation at Kaiser's Fontana pipe mill

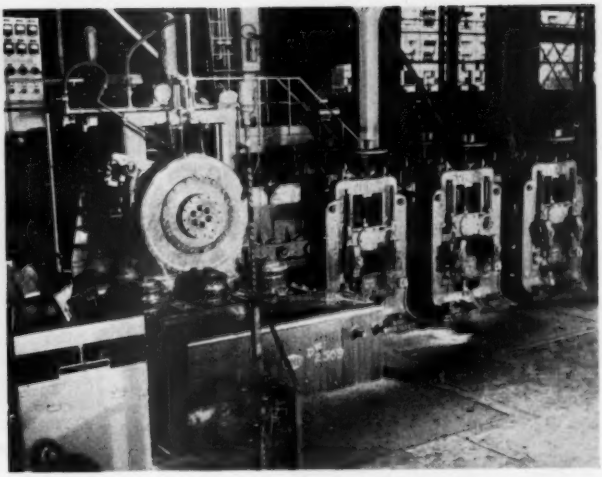
(See Front Cover)

KAISER STEEL Corporation's seam-welding pipe mill at Fontana, Calif., has been in operation about a year and a half, producing pipe from 5 9/16 in. to 14 in. in diameter with a maximum gage of 0.400 wall thickness. This element of the Kaiser Steel plant is notable for many novel features, including continuous magnetic-particle inspection of welded seams.

The site at Fontana, 45 miles east of Los Angeles, close to the city of San Bernardino, contains 1,300 acres for a fully integrated steel plant having its own coke ovens and blast furnaces as well as open-hearth furnaces and steel-finishing facilities.

The "electric weld" pipe is made from skelp, a product of the 86-in. hot strip mill, and is delivered to the pipe mill by railroad cars within the plant. The skelp is delivered in cut lengths that are straight, flat and uniform in width and thickness. Piles or "lifts" weighing from 20 to 25 tons

4—CIRCULAR form is given to the skelp by passing it between side pressure rolls



5—AS PIPE, open at the top, moves into the welding throat, two revolving electrode wheels bring a heavy current to the pipe edges

Line Production of Pipe

are unloaded and placed in the storage area according to size, gage, grade and length. A lift is placed on the "depiler" skids by the overhead crane with a spreader designed for this purpose. An overhead magnet or "depiler crane" picks up one plate at a time and places it on a roller transfer table to start the conversion into pipe.

First, the roller table carries the skelp to the roller leveler, where it is flattened sufficiently to allow it to enter the shotblast cleaner. At this point, the bottom surface of the skelp is cleaned for some 5 in. in width on each side of the plate. The cleaned skelp is then transported by roller table to an "up-cut" shear, which gives a square cut to the front end to insure proper entrance into the forming mill. From here, the skelp goes to a rotary side trimming shear, which trims it to a width governed by the OD of the pipe being made. At this point, we have a flat sheet of skelp that has been cleaned and trimmed and is ready to enter the forming mill.

Forming and Welding

Forming, welding and sizing of the pipe is a straight-line operation. Fig. 1 shows the equipment it takes to do the complete job. The forming mill itself consists of a pinch roll, an edge trimmer and a series of ten stands of rolls. Skelp enters the forming mill at the pinch roll (Fig. 2), which takes it through the edge conditioner. This machine is designed to dress the rough edges left from the previous shearing operation.

The dressed skelp now enters the roll forming stands of the mill. A U-shaped skelp emerges from the last of four stands of U-ing rolls (Fig. 3); this passes between side pressure rolls (Fig. 4) to achieve a more circular form. When the pipe has passed through all the stands, it has become almost wholly circular except for a gap of about 3/8 in. left between the edges. The last three stands have fin passes, where fins act as guides to control the position of the seam before the pipe enters the welding unit.

The resistance-welding unit (Fig. 5) has two copper discs 2 ft or so in diameter separated by insulation. These electrodes are machined to the radius of the pipe; a different set of electrodes is thus required for each size of pipe manufactured. The electrode wheels revolve at the same speed as the pipe travels and transmit a low-voltage (7½ to 10 volts)

6—CONCAVE rolls work with convex rolls to straighten the pipe

alternating current of 115,000 to 200,000 amperes to the two edges of the pipe. The resistance encountered between the edges generates heat sufficient to bring the edges to a plastic state.

As the open pipe moves into the welding throat, the revolving circular electrodes contact the pipe edges. Two side rolls and a bottom roll exert pressure, which fuses the edges. Carefully controlled coördination of speed,

7—MAGNETIC-PARTICLE inspection is made continuously to detect any flaws that may exist in the weld

8—TESTED in a crush press, this particular weld didn't break until pipe had been crushed nearly flat

pressure and current produces a metallic bond of the same character as the parent metal.

Just enough metal is extruded inside and outside the pipe to insure a full, perfect weld. While the extruded metal or "flash" is still plastic from welding, it is removed from both inside and outside by a pair of stationary cutters. These leave the wall at the weld the same thickness as any other section of the pipe.

Sizing and Straightening

The sizing mill consists of several stands of rolls, some diagonally placed, some stands horizontal and some vertical. These rolls are of accurate contours and progressively smaller diameters. Their purpose is to reduce the diameter of the pipe slightly in order to attain accurate size and concentricity. Cold working of the metal here and in the forming and welding rolls produces a marked increase in yield point and tensile strength without sacrifice of ductility. The sizing mill also completes the removal of scale.

After sizing, the pipe is straightened in a roll straightener consisting of several sets of revolving concave and convex rolls (Fig. 6). The pipe lengths are then conveyed to an inspection table, where ends are marked for cropping.

Magnetic-Particle Inspection

Most important to the quality of the finished pipe is the continuous magnetic-particle inspection that is made both inside and outside. How this is done was told in detail in the article, "Automatic Inspection of Pipe," appearing in the February, 1951, issue of The Welding Engineer. The inspection equipment (Fig. 7) is of the "outside yoke" type in which the magnetizing structure is wholly external to the pipe.

In magnetic-particle inspection, a magnetic flux of somewhat less than saturation is passed across the weld to be examined. A thin layer of iron powder is sprinkled over this area and then blown off. If there is no discontinuity in the weld, all the powder is blown off. However, when there is any crack or discontinuity in the weld, a local magnetic field is set up. The local field is sufficient to retain the iron powder on the surface, indicating the length and approximate depth of the defect.

Direct current flowing through the magnetizing coils produces the magnetic flux. The flux enters the pipe through an air gap and divides; one-half passes through the lower portion and one-half through the upper portion of the pipe. The flux that flows through the upper portion passes transversely through the weld, which is on top, and will therefore indicate the presence of a longitudinal crack.

After magnetic-particle inspection, the pipe passes to cut-off machines, where each end of every length is cropped for crush testing. The crush tests (Fig. 8) must meet the approval of an inspector for quality of both steel and weld. The length from which the end samples were cropped is held in the cut-off lathe until after the inspector has given his approval. When the inspector gives the green light, the cut-off machine bevels the edges for field welding or otherwise prepares edges as specified.

An emulsion under high pressure flushes particles of loose metal from the pipe. A hydraulic elevator then tilts the pipe length at the near end to allow the emulsion to run out.

The pipe is next given a hydrostatic test. Each individual length is placed in the testing unit with the weld on top and subjected to a pressure specified for the grade, diameter and wall thickness for a period of five seconds. The pressure is then reduced slightly and an inspector walks along the full length of the tube, closely examining it for possible minute defects.

After it has passed the hydrostatic test, the pipe length is given a final inspection and checked for tolerance, concentricity, wall thickness, straightness and surface defects, both inside and outside. Nothing is left to chance in this final inspection.

Each individual pipe that passes inspection is weighed, measured and stenciled. A coating machine with revolving brushes applies a protective coating against the weather. Finally, the pipe goes to the storage area, where it is held in readiness for shipment or sometimes loaded directly into cars for immediate transport to where it's needed.

Mill has a capacity of from 220,000 to 250,000 tons of pipe annually.

1—COVER PLATES for exhauster casing are held by ⅞-in. studs

2—ADAPTER assures proper stud alignment on the exhauster casing

3—FOUR SIZES of studs go on separator top of coal pulverizer

Faster Production by Stud Welding

AT THE East Chicago, Ind., plant of Combustion Engineering-Superheater, Inc., stud welding is saving time and money in the assembly of large equipment used for power and steam generation.

As an example, look at the coal pulverizer exhauster shown in Fig. 1, a dainty little thing of 6 ft 10 in. in diameter and weighing 118,000 lb. Studs of ⅞-in. diameter—largest size made—must be used to hold the bearing or cover plates in place against the excessive vibration encountered in operation. These studs are end welded to the frame member at the rate of four or five a minute.

Originally, the 1-in.-thick casing had to be drilled and tapped to fasten threaded bolts to the frame member. Drilling, tapping and stud setting took between 2 and 4 minutes per bolt. Stud welding requires less than 20 seconds for each stud. That's a considerable time saving when you figure that each side of the casing requires 48 of the outside studs. Even larger-diameter casings are made, requiring as many as 64 studs on each side.

Quick-Locating Device

One reason for the rapid welding job is the special locating device (Fig. 2) developed to assure proper alignment of the studs around the casing. The location of each stud is determined by a centerpunch mark, into which fits the pointed end of the granular-flux-filled stud. The adapter fastened to the gun includes two setscrews perpendicular to the stud. When gun and stud are in proper alignment, the ends of the setscrews (only one of which is visible in Fig. 2) are pressed against the inner surface of the casing to locate the studs on the bolt circle. After the operator has positioned the tip of the stud in the centerpunch mark, he holds the two setscrews against the inner surface of the casing and presses the gun's trigger. In effect, the locating device provides a tripod to assure that the stud will be welded squarely to the work and in a true circle.

Seventy-two studs in four different sizes are needed on the coal pulverizer separator top (Fig. 3). Studs of ¼-in. diameter secure the segment for the operating vane. The inspection cover for the top is held in place by ½-in. studs. Each of the access doors are secured by ⅝ by 2 in. studs. Finally, 18 large studs (¾-in.) secure the inner cone plate and rings to the separator top.

After all of the studs are located, the operator welds the studs of one size, changes chucks in the gun and welds the next size, etc.

Coal pulverizers aren't the only stud-welded equipment made at the East Chicago plant. There are also the steam generators that heat the cars of Diesel-powered trains and do small heating jobs and furnish process steam for industrial plants. Casing headers on steam generators (Fig. 4) require as many as 75 studs ½ by 1 in.

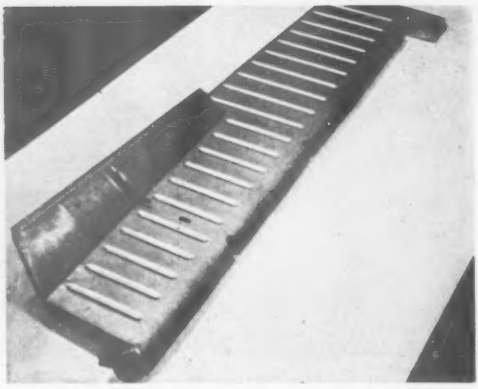
4—STEAM GENERATOR casing header needs 75 studs ½ by 1 in.

After the header has been fabricated from sheet steel, the studs are then end welded into position at a speed greatly exceeding the drilling-and-tapping method formerly used. Stud welding requires no expensive fixtures: in many cases the casing header is simply placed on the floor of the plant close to the welding generators.

• • •

Acknowledgment is made to the Nelson Stud Welding Division of Gregory Industries, Inc., for the photos reproduced with this article.

1—SPOT WELDING flanged baffles to the shell of an aircraft oil tank. High-quality welds can be obtained



2—ELEVATOR for a Bonanza airplane was completely assembled by spot welding, saving 120 parts per ship

Ways to Weld Magnesium

Our present preparedness program makes use of lightweight magnesium for aircraft structures, electronic devices, etc. Here are the ways in which it can be welded.

BY R. L. NELSON AND I. C. MATTSON*

DEVELOPMENT of applications for welded magnesium has closely followed the introduction of new welding equipment such as the electronically controlled spot welder and the inert-gas tungsten-arc process. Along this line, limited tests with automatic push-up flash welders indicate the possibility of many applications for this economical joining method. The inert-gas metal-arc process is also promising; recent work indicates that it will make possible rapid welding of heavy plate, especially in fillet welds.

All of this is very gratifying because magnesium is certainly important to the present preparedness program, where it is being utilized in such places as aircraft structures, electronic devices and lightweight ground force equipment. Weighing about two-thirds as much as aluminum of equal volume, one-fourth to one-fifth the weight of steel, magnesium alloys simply have no competition where weight saving is the primary consideration.

Let's look at some of the magnesium alloys. The most common sheet and extrusion alloys at present are Dowmetal FS1 and M. FS1 has a nominal composition of 3% aluminum and 1% zinc, and M alloy contains approximately 1.2% manganese. During World War II, the majority of applications requiring welding utilized Dowmetal M. In the latter part of the war, however, M alloy was gradually replaced by FS1, an alloy having better mechanical properties and better cold formability. This alloy also results in better weld efficiencies and longer tip life in spot welding. Unlike Dowmetal M, FS1 is not readily gas welded; for this reason gas welding is finding only limited use in present magnesium fabrication.

Other extrusion alloys currently popular are Dowmetal ZK60A and O1. ZK60A is not considered fusion weldable because of its high zinc content. O1 alloy extrusions contain approximately 3½% aluminum and ½% zinc and are considered arc weldable.

The melting range of M alloy is 1,200-1,185 F; that of Dowmetal FS1 1,160-970 F. Heat required to melt a given volume is roughly two-thirds that needed for aluminum and one-fifth the heat needed for steel. Thermal expansion is somewhat greater than with either aluminum or steel, and jigging must be ruggedly designed to overcome the tendency to climb and warp.

Spot and Flash Welding

Magnesium sheet and extrusion alloys are readily spot welded. Spot welds in magnesium have excellent static strength, but fatigue strengths are somewhat lower than for either riveted or adhesive-bonded joints. High-quality spot welds of consistent strength can be obtained, providing material surfaces are properly cleaned and welding machines have closely controlled weld current, electrode pressure and welding time.

Both alternating current and stored-energy machines can be used satisfactorily. Rapid pressure follow-up heads are required to maintain pressure on the weld during solidification because of the high shrinkage and high thermal conductivity.

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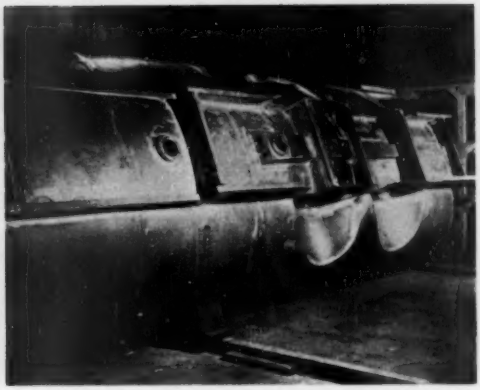
3—ARGON-ARC welding rear head to shell of magnesium 6,000-gallon semitrailer tank to convey gasoline



4—UNDERSIDE of the magnesium trailer tank at the rear. All welding was done with alternating current

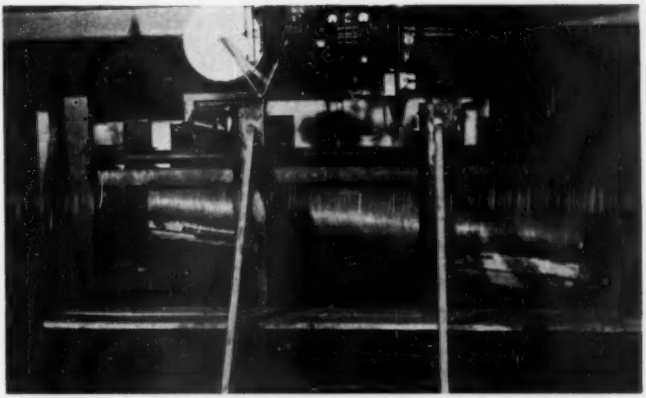
Alloys

Limited work with a-c machines incorporating recent developments in the way of frequency converters and modified current wave forms indicate that they may offer possibilities.

All types of stored-energy machines, including condenser discharge and electromagnetic, have been used successfully on magnesium alloys. With these direct-current welders, provision should be made to reverse the direction of current flow through the electrodes each time. This will equalize pick-up between electrodes and increase the periods between tip cleanings. The transfer of magnesium is greatest to the positive electrode. The electrodes should be cleaned often enough to prevent burning and transfer of copper to the magnesium surfaces. Copper pick-up must always be removed as it is a potential source of galvanic attack on the magnesium.

Hard, high-conductivity copper alloys meeting RWMA Class 1 specifications are used for electrodes for magnesium welding. The most satisfactory tip contours have been spherical or domed with a spherical radius of 2 to 8 in. depending on sheet thickness. The contact surfaces of the electrodes must be maintained in first-class condition. Fine-grit aluminum-oxide cloth backed by a soft rubber pad makes an ideal cleaning tool.

Electrodes should be water-cooled to within about $\frac{3}{8}$ in. from the weld-



5—AUTOMATIC WELDING head and jig used to weld the four longitudinal seams in the tail boom of a P-61 plane. Helium was the shielding gas

6—INSIDE of the tail boom welded in Fig. 5. Side, bottom and top skins are all of different thickness. Stiffeners are T-sections tack welded to the skins.

7—MAGNESIUM radar cabinet required the welding of many specially shaped extrusions to close tolerances

8—GAS WELDING subassemblies for oil tanks on the Bell P-39 Aircobra. Parts are of magnesium M alloy

ing face. The tip temperature should be as low as possible without moisture condensation on the faces. Condensation results in a sharp decrease in allowable intervals between tip cleaning. By allowing water to flow to the electrodes only when welding is in progress, the temperature level can be more closely controlled.

Both chemical and mechanical cleaning have been satisfactory in preparing magnesium surfaces for spot welding. Mechanical cleaning is used for a small number of parts.

For high production, a chemical cleaning process is recommended. Cleaning can be done this way most economically, and the low and uniform surface resistance obtained results in more consistent welds as well as about double the number of spots between tip cleanings. Allowable storage time after cleaning is also much longer. Chemically cleaned surfaces can be welded up to 100 hours after cleaning, while parts mechanically cleaned should be welded right away.

A chromic acid cleaner gives a low and consistent surface resistance. The formula is 1.5 lb of chromic acid plus 0.065 fluid ounces of concentrated sulphuric acid per gallon of water. After the first degreasing, parts should be immersed in this solution for three minutes, followed by cold and hot water rinses.

Material for spot welding should be purchased with an oiled protective coating. It should not be chrome pickled: chrome pickled surfaces are difficult to clean because of the surface etch.

No stress corrosion cracking of spot-welded magnesium has ever been observed to our knowledge, and no stress-relieving treatment after spot welding is normally used.

The experience obtained on a small scale indicates that flash welding can be adapted to high-production joining. M alloy is difficult to weld because of its narrow solidification range, but FS1, J1 and O1 have been flash welded to obtain joint efficiencies of 85% to 95%.

Rapid push-up is required because of the high conductivity of magnesium and its narrow freezing range. Machines with automatic push-up should be used. The oxide film does not have to be removed prior to welding as is necessary with other types of magnesium welding. No flux or protective atmosphere is required.

The application of the stud-welding process to magnesium has proved feasible. Projections, threaded studs and bosses can be attached to surfaces rapidly and economically.

Savings for Aircraft

Figure 1 is a view of the spot-welding area in the Dow magnesium fabrication plant. Flanged baffles are being spot welded to the outer shell of an oil tank. The baffles have been cleaned mechanically, a method used exclusively prior to the development of a suitable chemical cleaner. Thousands of these oil tanks were produced during the last war for P-39 fighter planes.

Complicated fabric-covered aircraft control surfaces such as flaps, ailerons and elevators have been replaced by formed magnesium sheet control surfaces. FS1-H24 0.025-in. skins are spot welded to an 0.025-in. FS1-H24 spacer in a three-ply welded joint. Thousands of these surfaces have been installed on Beechcraft "Bonanzas" in the past four years with a trouble-free service record. Tooling required for the fabric-covered aileron amounted to 102 tools as compared with 45 tools for the magnesium aileron.

Data on the number of parts saved by converting from fabric-covered surface to spot-welded magnesium are listed in the following table:

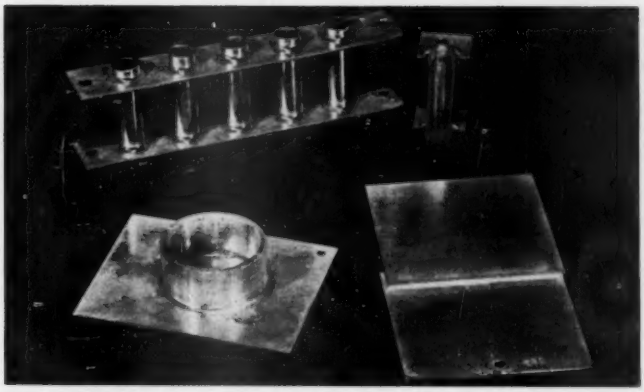
Control Surface	*Saving per Ship*
Flaps	121 parts
Ailerons	96 parts
Elevators	120 parts
TOTAL	337 parts

Weights saved are:

Control Surface	*Saving per Ship*
Flaps	4.0 lb
Ailerons	None
Elevators	2.0 lb
TOTAL	6.0 lb

Figure 2 shows a completely assembled elevator for a Bonanza. Spot welds join the skin to the spar. The two fabric-covered elevators have 154 parts, the magnesium surfaces 34 parts. The labor saving over the previous fabric-covered aluminum aileron was 10¾ man-hours per ele-

9—FINAL assembly by gas welding of the tanks for the Aircobra



10—FURNACE BRAZING is adaptable to magnesium, but only a few commercial applications have been found. Here are some typical brazed joints

vator. In addition to the saving in manufacturing time, stronger and stiffer structures were obtained.

Magnesium Arc Welding

Arc welding has played an important part in the more than two-fold expansion of magnesium fabrication within the last four years. As you may remember, the inert-gas welding process was developed specifically for use on magnesium in late 1941. Both the Dow Chemical Co. and Northrop Aircraft developed the d-c welding method, using reverse polarity, a tungsten electrode and helium gas for shielding. This method is still being used, but it is not so popular as the use of alternating current with high-frequency stabilization. The advantage of alternating current is in the greater current-carrying capacity of the tungsten electrode and the resulting greater penetration obtained.

With a-c, either helium or argon may be used as the shielded gas. Some operators prefer helium on the grounds that better penetration and faster speeds are possible. Also, there is a lesser tendency for "popping" in the arc when using currents near the maximum rating of the tungsten. For d-c reverse-polarity welding, it is well agreed upon that helium is the most practical gas. With argon, the arc becomes erratic except at extremely short arc lengths.

Inert-arc welding permits the so-called "hot short" alloys or alloys of wider solidification range to be welded. These are the magnesium-aluminum-zinc alloys such as Dowmetal FS, J, O, H and C alloys, the latter two being casting alloys. With gas welding, only the magnesium-manganese alloy, Dowmetal M, was considered weldable. At present almost all magnesium fabricators are using Dowmetal FS alloy (3% aluminum, 1% zinc). This alloy has much better strength and toughness properties than M alloy and also gives much higher weld joint efficiencies. The average strength of arc welds in FS alloy is 35,000 psi, over 95% of the strength of the annealed parent metal. M alloy arc-weld strength is about 18,000 psi, giving a joint efficiency of only 55%. This lower joint efficiency is due to the greater propensity of M alloy towards grain growth in the heat-affected zone. Tensile strengths and joint efficiencies of arc-welded magnesium alloys are given in Table I.

To get a sound arc weld in a magnesium alloy, the joint must be free from organic materials, which liberate hydrogen and cause porosity. Complete penetration is also an absolute necessity. Most operators find it easier to arc weld magnesium than aluminum. Given proper equipment, it is possible to make single-pass

Table I. Tensile Strengths, Psi, of Arc-Welded Wrought Magnesium Alloys

Alloy	*Filler Rod*	*Form*	*Strength of Parent Metal*	*Strength of Welded Joint*	*Joint Efficiency, Percent*
M-O	M	Sheet	33,000	20,000	60
M-H24	M	Sheet	37,000	22,000	60
FS1-O	J1	Sheet	37,000	32,000	86
FS1-H24	J1	Sheet	43,000	35,000	81
FS1-O	C	Sheet	37,000	32,000	86
FSI-H24	C	Sheet	43,000	35,000	81
FS1	FS1	Extrusion	40,000	34,000	85
J1	J1	Extrusion	45,000	37,000	82
O1	O1	Extrusion	49,000	35,000	71

Table II. Stress-Relieving Heat Treatments for Welded Magnesium Alloys

SHEETS			EXTRUSIONS			CASTINGS		
Alloy	*Temp, F*	*Time, Min*	*Alloy*	*Temp, F*	*Time, Min*	*Alloy*	*Temp, F*	*Time, Min*
FS1-O	500	15	M	500	15	H	500	60
FS1-H24	300	60	FS1	500	15	C	500	60
			J1	500	15	A	500	60
			O1	600	15			
MO	500	15	O1-T5	400	60			
M-M24	400	60						

welds in plates over one inch thick without doing any beveling or even spacing the plates.

Arc welds in any of the magnesium-aluminum-zinc type alloys are susceptible to stress corrosion cracking unless properly stress relieved. Residual stresses as high as 15,000 psi have been known to exist in magnesium arc welds. With FS alloy, the stress corrosion limit is around 8,000 psi, making it necessary to stress relieve after welding. The standard shop practice is to stress relieve at either 500 F for 15 minutes or 450 F for 30 minutes in the case of FS-0 (annealed material), and around 300 F for one hour in the case of FS-H24 (hard-rolled material) to retain its higher properties. Table II gives stress-relieving data for various alloys used for sheets, extrusions and castings.

To avoid stress relieving, some fabricators are prone to use M alloy, which is not susceptible to stress corrosion cracking. When one considers the overall advantages, however, Dowmetal FS is better material. The 35,000 psi tensile strength of welds in FS alloy is unusually high when compared with the strength of welds in other light metals.

Except for a special sheet containing a maximum of 0.04% calcium, all magnesium FS1 alloy sheet contains calcium up to 0.16%. Even this low amount of calcium may cause cracking when highly restrained joints are welded. In most cases, however, cracking can be avoided by tight jigging and chilling of welds, small weld beads and the use of a wide solidification weld rod composition such as Dowmetal C alloy. At present, no calcium is being added to extruded material.

Magnesium Semitrailer Tank

The 6,000-gallon semitrailer tank for gasoline pictured in Figs. 3 and 4 was built by the Butler Mfg. Co., Kansas City, Mo. This all-magnesium tank transport has now been in service approximately two years, and its performance has compared favorably with other experimental tanks of non-ferrous material.

The shell was machine welded first and then rolled to contour. The sheet material was a low-calcium alloy ranging in thickness from 3/16 to ¼ in. Both Dowmetal J and C welding rods were used. All welding was done with alternating current using argon for shielding. Figure 3 shows the welding of the rear head to the inside of the wrapper shell. The heads and the tank trailer bulkheads were each welded from two pieces and then dished and flanged after welding. Flanging was done at around 500 F.

Underside structure at the rear of the tank is shown in Fig. 4. FS alloy extrusions and formed shapes were used for the undercarriage structure. In making the circumferential welds on the tank shell, a magnesium band was used for a back-up; this also kept the tank in alignment and minimized distortion.

After welding was completed, the tank was tested for tightness and stress relieved around 250-300 F for about 20 hours. Non-pickled areas around the welds were then brush pickled to prepare the surfaces for paint.

Jig and Automatic Head

The welding jig and automatic welding head shown in Fig. 5 were used to make the four longitudinal weld seams in the tail boom of a P-61. An automatic voltage control setting of 18 arc volts was used for welding with d-c reverse polarity and helium. The control will not operate properly if argon is used.

To obtain uniform penetration along the 9-ft seams, direct current welding was dropped in favor of alternating current. This makes the welding conditions, such as speed and current, less critical.

The inside of the tail boom is shown in Fig. 6. FS1-H24 sheet and FS1 extrusions were used. The side skins were 0.102 in., the bottom skins 0.080 in. and the top skins 0.128 in. The circumferential stiffeners were T-sections tack welded to the skins. Since the skin had to be smooth on the outside, we had to use magnesium bands to back up the tack welds; otherwise there would have been a protrusion on the outside of each tack weld. The completed weldment was stress relieved at 300 F for one hour.

Figure 7 shows another arc-welded job, a magnesium radar cabinet. This design is quite complicated for a welded structure because of the close tolerances of ± 1/32 in.

Gas Welding

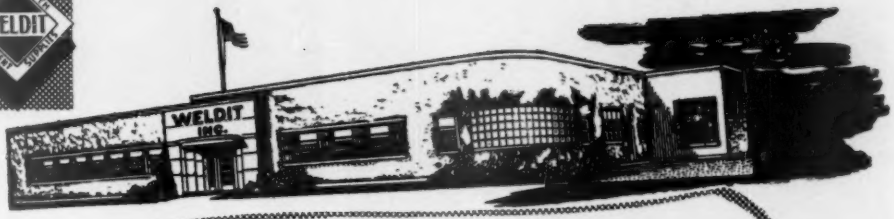
Gas welding has the advantage over arc welding on light-gage sheets in that fit-up is not as critical and less extensive jigging is required. However, it is not too satisfactory on alloys other than Dowmetal M because of weld cracking. M alloy filler rod is used in most cases except where one approaches the technique of torch brazing. Welding gas combination may be either oxyacetylene or oxycarbonhydrogen. The thinner gages, up to 0.064 in., are best welded with an oxycarbonhydrogen gas because of its soft flame. Also, acetylene tends to result in pitting on the weld surface.

As in aluminum gas welding, all traces of flux must be carefully removed as any chlorides remaining will cause rapid corrosion. Flux is removed by first washing the weld area in hot water and then giving it a chrome pickle and finally a one to two hour boil in a 5% solution of sodium dichromate, which neutralizes the flux.

Joints to be gas welded must be designed so as not to entrap flux or make flux removal difficult. Only butt welds and corner welds are satisfactory; other types must be avoided. T-welds should be welded from one side only. Thickness should be limited to a maximum of ¼ in. so that single-pass welds can be made.

As examples of magnesium gas welding, Figs. 8 and 9 show work in progress for aircraft oil tanks. In Fig. 8 subassemblies are being welded. The material is Dowmetal M sheet for the drawn heads and wrappers and M alloy castings for the fittings. Final assembly is shown in Fig. 9. This tank was used for the Bell P-39 "Aircobra," and thousands of them were produced during World War II.

Furnace brazing is a process readily adaptable to Dowmetal M. However, only a few commercial applications have come up since the technique and the flux were developed within the last few years. Figure 10 shows a set of typical furnace-brazed joints. The material is Dowmetal M sheet and extrusions. The temperature was 1,130-1,160 F, and the brazing time two to three minutes. A flux was used, but no special atmosphere was required. Strengths of the brazed joints are about 15,000 psi.



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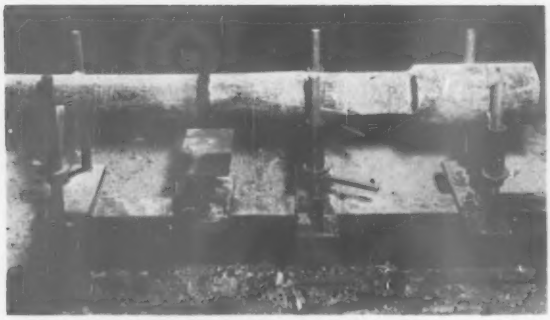
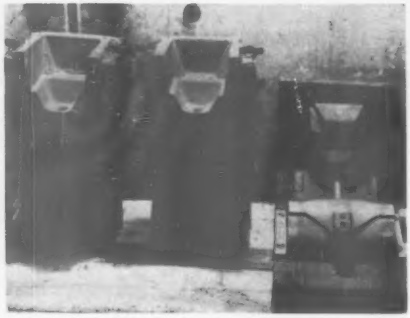


1—PREPARING for thermit weld on a drill stem. A straight gap is left between the flame-cut ends. Jig holds alignment



2—SAND MOLDS are made from a pattern of size corresponding to the stem being welded

Thermit Helps Texas Drilling

Recently, thermit welding has been applied in the Texas oil fields to repair drill stems (see pictures on this and the opposite page) and drill collars (page 60)

BY JACK I. MEDOFF

TOOLS that drill oil wells lead a tough life. The breakage and wear experienced with the ever increasing amounts of drilling are such that oil-field maintenance and repair shops are always on the lookout for new ways to prolong the useful life of operating equipment. The arc and the oxyacetylene welding processes are called in constantly for hard-facing and other applications. Now it's the turn of thermit welding.

Thermit welding has long been used to fabricate and repair heavy sections of ferrous metal parts, especially in the heavy machinery and railroad industries. Typical examples are shafts, rolling machine frames and stern frames on ships.

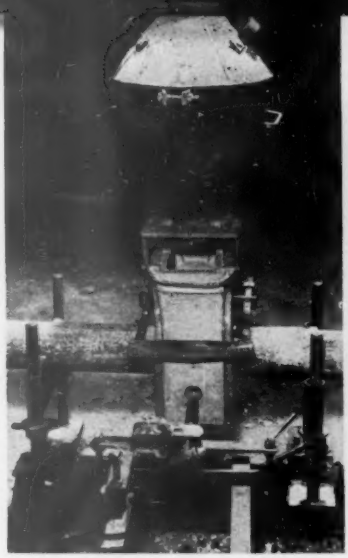
Recently, thermit welding has been successfully applied in maintenance of drill collars and stems, both of which will be illustrated and described here. The Empire Machinery Co., Ltd., of Odessa, Texas, is particularly keen about doing collar repairs by thermit welding.

WELDING A DRILL STEM

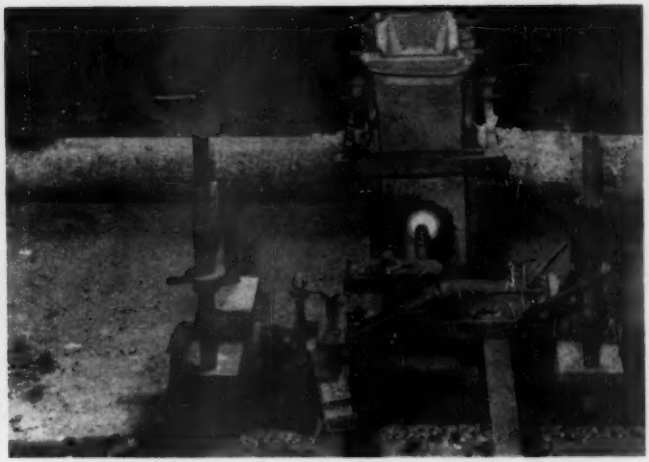
The first step in preparing for a

5—LIQUID STEEL is tapped from the bottom of the crucible into the mold. Thermit reaction produces molten steel at a temperature of 5,000 F

6—FLAME-CUTTING torch cuts off riser and gate from the weld



3—MOLDS are centered on the gap. Thermit crucible goes on top



4—PREHEATING FLAME is directed through hole at the bottom of the mold. When enclosed ends reach 1,700 F, the crucible is brought to the mold

thermit weld on a drill stem is to flame-cut the ends to be joined as squarely as possible. After the ends have been cleaned, the stem and the box or the pin are placed in a jig (Fig. 1) to facilitate alignment and to keep the pieces in place throughout the welding operation.

As shown in Fig. 1, a straight gap is left between the two ends. This straight gap is used on all thermit welds. The width of the gap is varied according to the cross-section of the area being welded.

To make the sand molds that are pictured in Fig. 2, a pattern is used. This pattern corresponds to the stem size being welded: a 5-in. stem requires a 5-in. pattern, a 4½-in. stem a 4½-in. pattern, etc. Special molding material, made especially to withstand the high temperatures of the thermit steel, is rammed into a mold box around the pattern. Split molds are employed.

After the molds have been made, they are placed around the stem, with the center of the molds centered on the gap, as illustrated in Fig. 3. The enclosed ends are then preheated to 1,700 F by means of the preheater pictured in Fig. 4. When the desired heat is reached, the crucible containing the thermit compound is placed on the top of the mold (shown in Fig. 3).

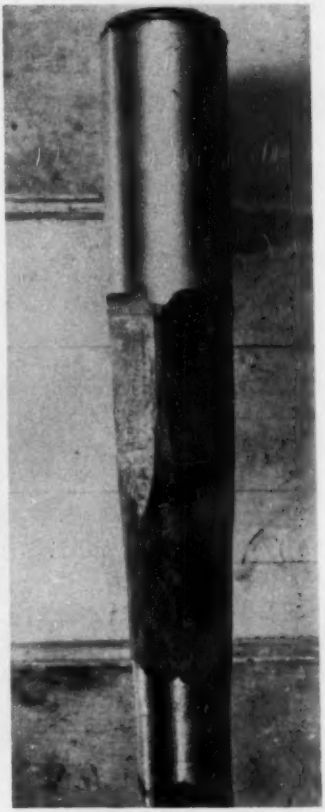
The hole through which the mold was preheated is plugged with sand, and the thermit mixture is ignited with special "starting thermit."

The reaction spreads rapidly throughout the mixture, generating intense heat and producing molten steel at about 5,000 F. It is complete in about 30 seconds, and the liquid thermit steel is tapped from the bottom of the crucible into the mold, as shown in Fig. 5. The completed weld is allowed to cool, after which the molds are removed and the gates and risers are burned off (Fig. 6). The stem is now ready for use. At the bottom of Fig. 7, we can see the thermit weld after it has been machined down to the shaft size of the stem.

A thermit-welded stem put in service in the Bradford area of Pennsylvania was still in use after more than a year of duty, in which it drilled over 20,000 ft. Nearly 150 thermit-welded stems have since been put into service in the same area, some as small as 3 in. in diameter, and others as large as 5½ in. in diameter. These stems range in length from 14 to 46 ft, and welds may be located anywhere from the box throughout the length of the stem to the pin.

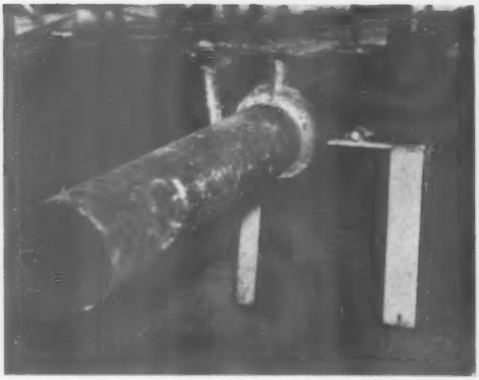
"Stubbing" Short Collars

In oil fields where long strings of drill collars are employed, excessive stresses will cause either breakdown or extreme wear on pins and boxes. In either case, the collar must be sent to a machine shop to have the pin and box threads recut. Several such trips will shorten the collar to the



7—COMPLETED job. The thermit weld is at bottom and has been machined down to shaft size of stem

8—"STUBBING" a drill collar. In this picture, mold is being packed with clay in order to seal the cracks



10—FINISHED WELD adds a section to drill collar. Riser, gate and weld collar are still in place

9—THERMIT REACTION produces molten steel in crucible above mold

point where it is very difficult to use in drilling. To avoid discarding the collar, machine shops have devised various methods of adding a short section of a new collar to either or both ends of the old one—a procedure known as "stubbing."

The bore of the old drill collar is first built up by means of arc welding to a diameter a little less than that of the piece to be added—a necessary step because the old collar bore has usually been enlarged by erosion from high-velocity streams. The built-up bore is then machined (down) to the same diameter as the new piece, and matching ends are cut off square. After cleaning, the two pieces are joined by thermit welding.

Figure 8 shows the mold being packed with clay around the drill-collar joint to seal the cracks. The welding procedure is substantially the same as that used for drill stems. In setting up the hollow sections for welding, however, a short length of snugly fitting bar stock is inserted in the bore at the joint to help maintain alignment and to provide a dam when the weld is poured after the thermit reaction (Fig. 9).

Figure 10 shows the finished weld with riser, gate and weld collar still in place. Drill collars are generally normalized after being welded to relieve stresses that may have developed as a result of temperature differences between the weld metal and the drill collar metal. After this stress relief, the weld collar is machined off the outside of the joint and the weld metal and bar stock inside are bored out.

The thermit process is also used for lengthening drill collars and kellies and for replacing bad sections. Many other heavy-duty oil field repair jobs are feasible: there is practically no limit to the size or shape of the section that can be welded with thermit.

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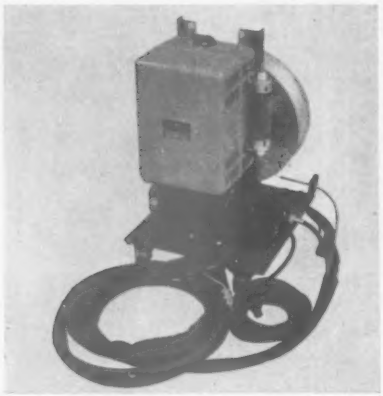
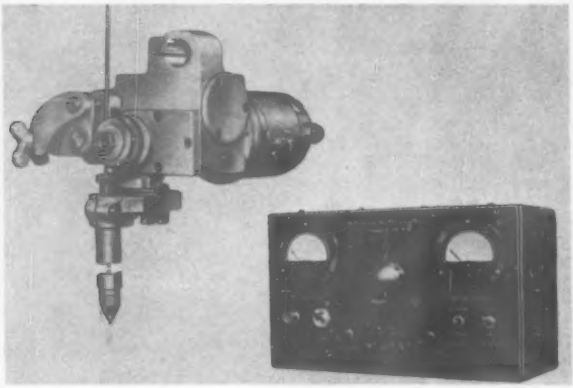


CONTINUOUS electrode wire of carbon steel, stainless or aluminum used to "Fillerweld"



COMPLETE AUTOMATIC control of head and positioner is claimed for new Mir-O-Col automatic welder. Current capacity is 2,000 amp

G-E "Fillerweld" Process

WELDING jobs requiring filler metal can be considerably speeded by using the new General Electric "Fillerweld" inert-arc metal arc process. Speed is greatest on sheets up to 3/16 in. thick, but if speed isn't essential, high-quality welds can be made in much thicker material.

"Fillerweld" allows the weldor to control the continuous flow of filler metal without breaking the arc. The operator uses a finger switch on the hand-held "gun" to start the wire feed mechanism as soon as he sees that a molten pool has been formed on the base metal. He may stop the wire feed at any time, even during welding, by releasing the trigger switch.

Two main elements make up the operating mechanism of "Fillerweld;" the hand-held torch and the power apparatus. The latter consists of a motor for drawing the filler wire along, a "Thy-mo-trol" motor control and a spool for holding the filler wire. It is mounted on a portable platform.

Inexperienced operators can be trained in relatively short time to operate "Fillerweld," G-E claims. Experienced gas or arc weldors learn to use it after only a few minutes' experimentation.

With a G-E type WP inert-arc welder, the process can be used to join aluminum, magnesium or beryllium copper; with a G-E type WD-4150 or WD-4200 Welder, to join stainless, copper, Inconel, steel and other weldable alloys. Either argon or helium can be used as shielding gas.

GENERAL ELECTRIC Co., Schenectady 5, N. Y.

* * *

Semi-Insulated Electrode Holder Protects Weldor's Hand

SEVERAL new features are presented by the Caddy Type A semi-insulated electrode holder, available in 300 and 500 amp capacities. A hand-guard that shields the weldor's hand from heat, spatter and slag. Greater heat dissipation is claimed for a newly designed channel-shaped body. An enclosed coil spring assembly is protected from spatter by the handle. An extra-large hinge pin is said to outwear the normal-size pin. After the cable is worn and is ready to be changed, the old cable can be cut off and the new cable "Cadwelded" to the replaceable stud on the holder.

ERICO PRODUCTS, INC., 2070 East 61st Place, Cleveland 3.

New Automatic Welder

TOTALLY new design and performance features are claimed for a new fully automatic welding head, the Mir-O-Col Model 944. Principal new feature is completely automatic control of both welding head and positioner as well as the high-frequency pilot circuit, if used.

The head driving motor was designed and built by Mir-O-Col especially for the head and operates on either or both the welding voltage or a separate 110-volt source. It is electrically independent of the positioner and welding transformer power supply.

Feed rolls are driven through a special gear-reduction train having gears and bearings that are easily replaceable. They can be adjusted to fit any electrode between 1/8 and 3/8 in. The electrode nozzle is cast from a special Mir-O-Col alloy.

Controls include a manual "inch-er," welding voltage control to regulate deposit rate, both manual and automatic movement of positioner, transformer and h-f unit and welding current control if equipped for remote control. Welding voltage and current meters are provided. Connections are made through simple multiple-conductor connectors. The head is designed to operate with any positioner or transformer. Current capacity is 2,000 amp.

MIR-O-COL ALLOY Co., 312 North Avenue 21, Los Angeles, 31.

for welding

Expendable Electrode Tip Saves Spot Welding Shortages

NEW "Kaptrode" expendable tip for spot welding electrodes save up to 75% copper in production operations. The electrode consists of the expendable cap or tip which fits in a semi-permanent adapter shank.

Six tip sizes or styles are available, pointed, dome, flat, offset, truncated cone and radius face in three RWMA alloys, Class 1, 2 and 3. No. 1 and 2 Morse taper sizes are made.

Adapter shanks are made at present in two Morse taper sizes and nine lengths ranging in ¼ in. steps from 1¼ to 3¼ in. All "Kaptrode" electrodes fit interchangeably into any adapter shank of corresponding Morse taper size and project ¾ in. from the shank. Thus, with the proper shank length, it is possible to duplicate standard electrode lengths and use them with change on established machine set-ups.

The "Kaptrode" electrode is fitted into the adapter shank with a blow by a rubber or rawhide mallet and are removed with a special "Kaptrode" extractor.

Tests show that one adapter shank outlasts 10 expendable tips. At this rate, electrode costs are reduced 20% or more.

WEIGER WEED & CO., 11644 Cloverdale Ave., Detroit 4., division of Fansteel Metallurgical Corp.

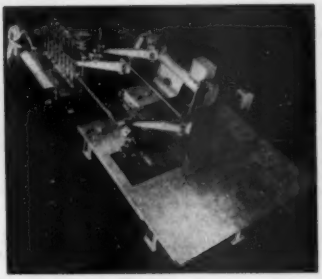
* * *

Plastic Cement Makes Small Welding Jig

A NEW plastic cement product named "Form-A-Jig" will hold metal parts for welding, brazing or soldering, since it does not deform, swell or move under heat. It also shields or protects parts from flame. It does not soil metal, mar the surface or corrode it, says the maker.

EUTECTIC WELDING ALLOYS CORP., 172nd St. and Northern Blvd., Flushing, N. Y.

* * *



Airco 50 "Travograph" for Heavy-Duty Cutting

NEW AIRCO No. 50 "Travograph" is a heavy-duty machine of the pantograph type for precision flame-cutting. It may be guided by manual, magnetic or electronic tracer and will cut an unlimited variety of shapes from steel plates, slabs, billets or forgings. "Thym-o-trol" control of the motor driving the carriage provides accurate variations in carriage speeds of from 2 to 168 ipm.

Other features of the new machine are: an all-welded, heavy-gage steel frame; a rigid rail assembly; tracks with accurately machined surfaces to provide a smooth runway for the carriage; guide rollers to keep the carriage o na vibration-free course; flame-hardened carriage wheels; precision-machined operating bar for torch holders; ball bearings incorporated in the pantograph arm hinges and operating bar, resulting in smooth, accurate response to the movement of the tracer; a carriage remote control box that can be mounted on the operating bar along with remote controls for the gas distribution system and other auxiliary equipment.

AIR REDUCTION, 60 East 42nd St., New York 17, N. Y.

* * *

New Type Starter for D-C Arc Welders

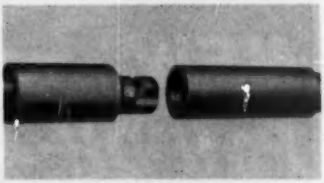
A NEW starter, basically a fused high-capacity interrupter switch, is being used on all production models of General Electric's type WD-42, -43 and -44 motor generator d-c welders.

The new starter provides positive motor starting because the contacts are locked in by mechanical action, according to G-E. A direct-acting lever physically closes or opens the contact when it is operated, affording direct control over starting and stopping. This reduces maintenance by eliminating circuit coils, magnetic contacts, etc., which might fail or malfunction. A time-delay fuse connected directly in the line protects the motor circuit from overload.

The new starter is mounted on the end panel of the welder control box, which has been redesigned for easy access to fuse and connection terminals.

GENERAL ELECTRIC CO., Schenectady 5, N. Y.

* * *



Cable Connector Uses Double Cams

IMPROVED "Cam-Lok" welding cable connectors made of solid brass utilize a double-cam principle. One cam exerts pressure parallel to the axis of the connector and the other a perpendicular pressure. By this means, a contact approaching the 600 psi required for minimum resistance is obtained.

General-purpose "Cam-Lok" connectors (for 1/0 through 3/0 cable and No. 2 through 1/0 whip ends) are completely interchangeable with heavy duty "Cam-Lok" connectors and with female terminal connectors. Long runs of cable can be graduated from 4/0 down to a light whip end for maximum flexibility and minimum voltage drop. No adaptors or reducers are needed. It is self-compensating for wear, locks tight, releases easily, has no spring action and reduces arcing and burning to a minimum.

CAM-LOK DIVISION OF EMPIRE PRODUCTS, INC., P. O. Box 98, Cincinnati 36, O.

* * *

(More New Products on page 90)

JIM, HOW ARE WE GOING TO DO ALL THIS CUTTING AND WELDING...AND STILL MAKE DELIVERY ON TIME?
THAT NEW P&H ELECTRODE IS THE ANSWER, BILL. DH-4, THE FASTEST ROD WE'VE EVER BURNED!

NEW P&H DH-4 Electrode

For high-speed welding — cutting and gouging

...perfect X-Ray welds on heavy metal sections without machining or scarfing

This is the most unusual rod ever developed. It has so many applications that the American Welding Society does not have an AWS number for it.

Because of its wide range of usefulness the new DH-4 rod has shown outstanding economies in welding time and costs.

Here are a few of its many advantages: Fast deposition rate. Easy manipulation. Welds mild steel to mild steel without processing. Has extremely high penetration — 1/4-inch with 1/8-inch rod at 300 amps. Cuts time on horizontal fillet welds, flat butt welds, and vertical down welds. Ideal for gouging and cutting. Gives excellent results on Hadfield manganese and high-carbon steels.

If you want to give your production a lift and reduce your costs, you'll want to know more about the unusual DH-4. See your P&H representative or distributor. Write us for details.

Specialized Training in Metal Welding Fabrication
1 week to 18 months
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in conjunction with
Milwaukee School of Engineering
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3 SIZES AVAILABLE
1/8", 5/32" and 3/16"
Operates off DC welder on straight polarity or AC welder with minimum open-circuit voltage of 80 volts.

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Specifications for Ferrous Metals

MATERIAL		A.S.T.M.	A.S.M.E. (Boiler)	C. Max.	Mn. Max.	Si. Max.	Cu. Min.	Tensile Kips Min.	Yield Point Kips Min.	Elon. in 2" % Min.	Red. in Area % Min.	REMARKS
Structural	Bridges } Buildings }	A7-50T					.20	60/72	33 min.	22		Rolled Steel Base Plates Over 1½" in Thickness C-0.20/0.33 %
	Mild Steel	A283-50T										
	Grade A						.20	45/55	24 min.	30		
	Grade B						.20	50/60	27 min.	27		
	Grade C						.20	55/65	30 min.	24		
	Locomotives	A113-50T					(1)	55/65	33	22		
	Silicon	A94-50T				.20 min.	(1)	80/95	45	17	30	
	Ships	A131-50aT						60/72	32 min.	22		
Boiler Steel	Locomotives Flange	A30-50T			.30/.80			55/65	0.5 T.S.	(2)		A30-50T (Firebox), Plates under ¾", C-0.25 %
	Firebox (Grade A)			.30	.30/.80			55/65	0.5 T.S.	(3)		T.S. 48/58 Grade B
	Stationary	A285-50T										
	Flange and Firebox Grade A			.15	.80		.35	45/55	0.5 T.S.	(4)		
	Grade B			.15	.80		.35	50/60	0.5 T.S.	(4)		
	High Tensile	A212-50T										
	Grade A			(6)	.90	.15/.30		65/77	0.5 T.S.	(5)		A212-50T Plates 4½" and under.
	Grade B			(6)	.90	.15/.30		70/82	0.5 T.S.	(5)		
	Iron Plate	A129-50T	SA-129									
	Type A			(7)	(7)	(7)		40	20	20(8")		
	Type B						.40	44	25	25 (8")		
	Type C						.20	42	22	22 (8")		
Wire for Concrete Reinforcement		A82-34						80	0.8 T.S.		30	ASA-A50.3-1936
Iron and Steel Chain	Crane, Proof	A56-39			.06							See Specifications for T.S. and Elong. Tests on Finished Chain
Steel Tubes and Pipe	Fusion Welded	A139-46										4" to 30" Diameters
	Grade A							48	30	30		
	Grade B							60	35	25		
	Fusion Welded	A134-42										30" Diam. and Over
	Resistance Welded	A135-46										
	Grade A							48	30	30		
	Grade B							60	35	25		ASA-B36.4-1942
	Lapwelded & Seamless Steel and Lapwelded Iron Boiler Tubes	A83-15	SA-83									
	Type A, Low Carbon Steel			.08/.18	.30/.60							Flatten., Flange, Crush, and Hydrostatic Tests
	Type B, Open Hearth Iron			.08/.18	30/.60							
	Welded Steel Pipe	A53-47										
	A. Bessemer							50	30	18 (8")		
	O.H. or E.F.							45	25	20		Also Hydrostatic and Flattening Tests
	Seamless Steel Pipe											
	Grade A							48	30	35		
	Grade B							60	35	25		
High Temperature Service	Fusion Welded	A155-42										
	Grade A			.17	.35/.60			45	0.5 T.S. 24 min.	(2)		Plates ¾" and Under C-0.15 %
	Grade B			.22	.30/.60			50	0.5 T.S. 27 min.	(2)		Plates ¾" and Under C-0.20 %
	Grade C			.30	.30/.60			55	0.5 T.S.	(2)		Plates ¾" and Under C-0.25 %
	Lapwelded and Seamless Seamless	A106-48T	SA-106									
	Grade A			.25	.30/.90			48	30	35		Also Flattening and Hydrostatic Tests
	Grade B			.35	35/1.00			60	35	25		
	Forged or Rolled Steel Pipe Flanges	A105-46	SA-105									
	Grade I				.90			60	30	25	38	
	Grade II				.90			70	36	22	30	
Carbon Steel Castings for High Temperature Service		A95-44		.15/.45	.50 min.	.20 min.		70	36	22	30	Also Hydrostatic Tests
Wrought Iron	Forgings	A73-39										
	For Locomotives and Cars Class A				.07			45	0.5 T.S.	24 (4")	30	
	Misc. Uses, Class B				.15			45	0.5 T.S.	24 (4")	33	
	Welded Pipe	A72-45	SA-72		.05			40	24	12 (8")		Also Hydrostatic Test
Iron Castings	Grey Iron Class No. 20 to No. 60	A48-48	SA-48					20/60				The Class No. Designates in Kips the Required T.S.-Transverse Tests Optional
	Grey Iron for Valves, Flanges, etc.	A126-42										
	Class A							21				
	Class B							31				Transverse Test Optional
	Class C							41				
	Malleable Iron	A47-48										
	No. 32510							50	32.5	10		
	No. 35018		S-15					53	35.	18		

(1) A113-50T, copper 0.20 % when copper steel is specified.

(2) A-30-50T and A155-42, Elong., 8" % min. = $\frac{1,500,000}{T.S.}$

(3) A30-50T, Firebox, grades A and B, Elong., 8" % min. = $\frac{1,550,000}{T.S.}$; 2" % min. = $\frac{1,750,000}{T.S.}$

(4) A285-50T, Elong., 2" % min. = $\frac{1,750,000}{T.S.}$ for material of ¾ to 2 in., inclusive, in thickness a deduction of elongation in 8" of 0.125 % shall be made for each increase of 1/32 in. of the specified thickness above ¾ in. to a minimum of 22 % for flange steel and 23 % for firebox steel, Grades A and B; 21 % for flange steel and 22 % for firebox steel, Grade C.

(5) A212-50T, Elong., 2" % min. = $\frac{1,750,000}{T.S.}$ on the tension test specimen taken from the top of the firebox plates, shall not exceed 79,000 psi for Grade A, 87,000 psi for Grade B nor 70,000 psi for Grade C.

(6) A212-50T Grade A, C-.33 for plates 2 to 6"; .31 for plates 1 to 2"; .28 for plates 1" and under. Grade B, C-.35 for plates 2 to 6"; .33 for plates 1 to 2"; .31 for plates 1" and under.

(7) A129-50T total metalloids: C, Mn, P, S, and Si, max %, 0.10 type A, 0.25 types B and C, S max % .040 all types; P, max %, .015 all types.

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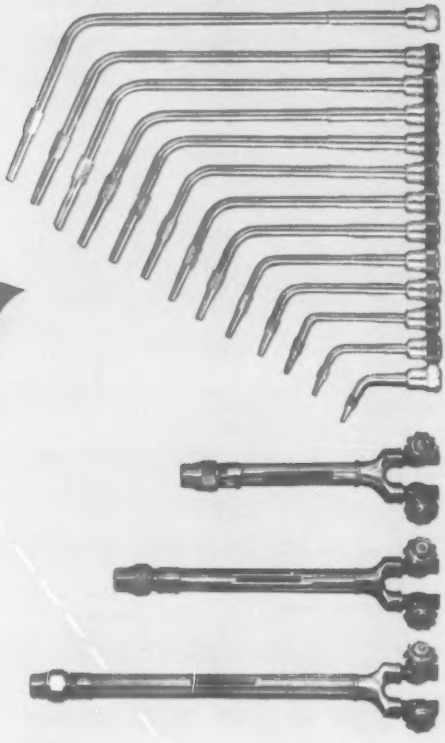
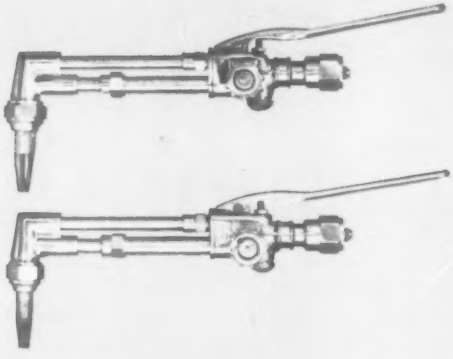
Gases eat up 87¢ of your gas welding and cutting dollar*. Stretch that 87¢ by buying VICTOR equipment. It's designed for wide flexibility of flame control, greater operator efficiency, gas savings and long life. See for yourself why so many welders say it costs less to own and operate VICTOR.

*Source: Welding Engineer 1951 Products Reference Number.





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A Welding Engineer Reader Service

1 NICKEL ALLOY WELDING—The International Nickel Co., New York City 5. New 44-page bulletin T-2 on the fusion welding of nickel and nickel alloys is a complete technical treatise on all phases of the subject. There are 30 tables, 50 drawings in some 20 chapters and sections. ASME boiler codes, pickling, testing, inspection are discussed.

2 WELDING FLUX CRUSHER—American Pulverizer Co., St. Louis 10. 8-page bulletin on laboratory crushers describes several models suitable for handling fused submerged-arc welding flux and reducing it to usable size and condition. Number of pounds per hour, grit sizes and operating methods are discussed.

3 EXPENDABLE SPOT-WELD TIP—Weiger Weed & Co., Detroit 4. Technical bulletin 14.100 tells about "Kaptrode" expendable caps for semi-permanent spot welding adapter shanks. Nose styles, taper sizes, lengths, how-to-install instructions and operating data are supplied. See page 63.

4 WELDING CABLE CONNECTOR—Cam-Lok, Div. of Empire Products, Inc., Cincinnati 36. Bulletin 101-W-62 gives complete details on a new "Cam-Lok" welding cable connector made of solid brass. Cam-operation for good contact is explained as is its adaptability. See page 63.

5 SEMI-INSULATED HOLDER—Erico Products, Inc., Cleveland 3. Literature tells about the new Caddy semi-insulated electrode holder of 300 and 500 amp capacities. Construction features such as spring assembly, handguard, replaceable stud and cable connection are explained and illustrated. See page 62.

6 NEW METALLIZING GUN—Metallizing Engineering Co., Inc., Long Island City 1, N. Y. Two 4-page two-color bulletins describe, respectively, the new 4E and 5E metallizing guns. Booklet telling about the 5E explains its special feature for spraying anti-corrosion metals. The 4E booklet tells about high-speed spraying with all metals at low cost and minimum maintenance. See page 90.

7 EXPANSION JOINTS—Solar Aircraft Co., San Diego 12, Calif. 40-page catalog lists over 78,000 possible combinations of bellows type expansion joints for piping and conduits. Made under the name of "Sola-Flex," these bellows assemblies range in size from ½-in. to 72-in. and cover pressures from near-vacuum to 1,000 psi.

8 AUTOMATIC WELDING HEAD—Mir-O-Col Alloy Co., Inc., Los Angeles 31. Literature tells about a new "truly automatic" welding head, Model 944, that uses a continuous electrode. Details of an h-f pilot circuit, head driving motor, gears, power supply, etc. are furnished with application data. See page 62.

THE WELDING ENGINEER will request manufacturers to send readers the literature in which they are interested. Two post cards are printed here, each containing space for four items.

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9 METAL FORMING MACHINE—Kilham Engineering, Inc., Plainville, Mass. Catalog gives operating characteristics of "Bendit" metal forming machines for rod, strip, sheet and tubing. Data on blades, capacities, stops, etc., is furnished. See page 92.

10 ELECTRODE DRYING OVEN—Fred C. Archer, Inc., Milwaukee 3. Literature tells about the Blueweld "Lo-Hydrogen" Electrode Stabilizer for keeping 400 lb of low-hydrogen electrodes in good-as-new condition under moisture pick-up situations. See page 92.

11 SPOT WELDING AUTOS—The Taylor-Winfield Corp., Warren, O. 4-page bulletin tells about spot welding by Flxible Company in manufacture of buses, ambulances and funeral coaches.

12 CAST IRON ELECTRODE—Eutectic Welding Alloys Corp., Flushing, N. C. Literature tells about "Eutectrode 26" for welding cast iron with high-strength results. Its welding action and technical specifications are also covered.

13 REPAIR WELDING TRACTORS—The Sight Feed Generator Co., West Alexandria, O. Single-sheet bulletin tells about recommended procedures for building up crawler tractor rails with "Rexarc S-3" nickel manganese electrodes. Illustration shows wrong and right ways to weld rail segment.

14 FLAME-CUTTING MACHINE—Air Reduction, New York City 17. 12-page Catalog 7 describes the No. 50 Travograph flame-cutting machine and discusses its machine assembly, gas distribution system, torch holders and cutting and tracing tables. Clear diagrams and photos show important details. See page 63.

15 NI-MO-VA ELECTRODES—International Nickel Co., Dept. EZ., New York City 5. 19-page report with 32 illustrations, diagrams and charts summarizes results obtained with commercial electrodes of a nickel-molybdenum-vanadium steel with a low-hydrogen coating. Written by three welding specialists at the Philadelphia Navy Yard, the report discusses steel weldments having 110,000 psi yield strength.

16 HOBART ELECTRODES—Hobart Brothers Co., Troy, O. Pocket-size booklet is a vest-pocket guide to Hobart electrodes and arc welding information. It discusses types of electrodes, color markings, types of joints, standard steel shapes, common welding troubles and proper welding procedures.

17 SLIP-ON SOLDERING TIP—Anzick Mfg. Co., Van Dyke, Mich. Single-sheet bulletin tells about a slip-on type soldering tip that fits over any standard welding torch. With it, the operator needs only an acetylene cylinder—no oxygen is needed because the tip utilizes ordinary air for burning.

18 METAL WORK BENCH—Natkin & Co., St. Louis 17, Mo. Single-sheet bulletin illustrates all-metal work bench with laminated wood working surface of "Nat-Flex," a substance that is non-conductive and resistant to oil, water and abrasion.

19 HARDENING COMPOUND—Eutectic Welding Alloys Corp., Flushing, N. Y. Illustrated folder TIS 512-P tells about "Instant Hardener No. 1 and No. 2" compounds for hardening of tools, parts, edges, threads, dies with the heat of a welding torch.

20 AIR CYLINDERS—Rivett Lathe & Grinder, Inc., Boston, Mass. Catalog section No. 55 tells about 28 different models of air cylinders. It contains working drawings and specifications and tells about all construction features.

21 FIRE EXTINGUISHER GUIDE—Randolph Laboratories, Inc., Chicago 11. Two-color, 12 x 22 in. poster tells employees the correct fire extinguisher to use on rubbish, wood, inflammable liquid or electrical fires. It also illustrates all types of extinguishers.

22 RUST REMOVER — Oakite Products, Inc., New York City 6. 6-page folder tells about Oakite Compound No. 33 for removing oil, rust and conditioning metal for painting. Cleaning action principle and results are described.

23 ARC-WELDING CATALOG—Precision Welder Mfg. Co., Chicago 10. New two-color catalog tells about all seven Precision "Shop King" welders, including amperage ratings, open-circuit voltage, heat stages, capacity of metals welded, dimensions and shipping weights.

24 PRESSURE SWITCHES—Barksdale Valves, Los Angeles 11. 32-page manual tells about electric-hydraulic pressure switches for industrial applications. Glossary of terms, tabulations and diagrams explain various switches.

25 LIGNUM-VITAE BEARINGS—Lignum-Vitae Products Corp., Jersey City, N. J. Literature tells of the advantages of bearings made of lignum vitae wood for steel mills, castor wheels for carts, pulleys, gibs, etc. over non-ferrous or plastic materials. Its natural self-lubricating properties are told also.

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THE WELDING ENGINEER, NOV. 1951

Will Defense Production Be Caught in the Squeeze?

When Congress revised and extended the Defense Production Act, it relaxed a squeeze on business profits.

President Truman asserted that this action by Congress cripples the government in its effort to prevent inflation which, as he puts it, could lead to "enrichment and profiteering for the few, economic hardship and misery for the many."

He asked Congress to rescind its action.

This editorial—the second on problems presented by "escalator"clauses—aims to throw some light on this conflict of opinion.

The Squeeze

The squeeze on profits was imposed in the name of price stabilization. The idea behind it was simple. The *selling prices* of industrial products were to be held under a tight lid. But many industrial costs are affected by "escalator" clauses of one kind or another which tend to boost production *costs*. Thus, with rising costs and fixed prices, profits would be squeezed and much of the cost of defense would thereby be shifted from those favored by escalator clauses to business concerns.

The mechanics of this squeeze on profits were complicated. But here, in brief, is how it was to work. The first step was to require manufacturers to set ceiling prices, effective May 28, for their products.

These ceiling or maximum prices were to allow for increases in manufacturers' costs that had occurred since Korea. *But they did not allow for all increases.* Manufacturers, for example, could not include increases in indirect costs—office or selling costs. Neither could they, in calculating their new prices, include increases in the costs of materials or direct labor that had come after March 15. This was the first phase of the squeeze on profits.

The second phase was prepared by not putting a ceiling on costs. The Wage Stabilization Board said it could not disturb the operation of "escalator" clauses by which wage rates are geared to the cost of living. Moreover, nothing could be done to curb the operation of the farmers' "escalator" clause, the farm parity arrangement. Under it, the federal government underwrites higher prices for farm products to match increases in the cost of things farmers buy. So this left wages and many materials costs free to rise against a ceiling imposed on the prices of what industry has to sell.

Relief—at a Loss

On two conditions only would the Office of Price Stabilization permit a company to raise its prices and escape this squeeze. One of these was that increased costs had more than wiped out its profits; in other words, that it was operating at a loss. The other condition was

that the industry of which the company is a part was not, as a whole, making "excess profits." That is, the industry, as a whole, could not get price relief if its overall profits before taxes were greater than 85 percent of its average profits during the best three of the four years from 1946 through 1949. Many companies expected that their profits would be cut drastically before they could get through this narrow escape hatch.

When this squeeze on profits was set up, we were told that industry as a whole was reporting record profits. But, it was equally true that wage rates and farm prices also were at record high levels. And it was also true that, under the impact of rising taxes and the dislocations caused by the defense mobilization program, profits actually were on the way down.

Profits—Going Down

By the time Congress acted to relax the squeeze, corporate profits, after taxes, were running at a rate 20 percent lower than they had been six months before. And the clear prospect was that they would continue to decline.

So the issue put up to Congress was simply this. Should business firms stand so much of the brunt of the defense costs while "escalator" clauses continued to exempt organized workers and farmers from paying their share of those costs?

But this question actually is much broader than one of fairness or unfairness alone. One certain effect of such a squeeze on profits would be to undercut the capacity of private industry to install the new plants and equipment needed for our mobilization effort. Today—unlike World War II—private industry is financing almost all of our huge program to expand production. And about two-thirds of the money that has been plowed into the expansion and improvement of our industrial machine since World War II has come out of profits.

In view of all this, Congress decided last summer to relax the pressure on profits. This was done by the controversial Capehart Amendment to the Defense Production Act. This amendment has serious administrative weaknesses. But some measure with the same purpose is needed to maintain profits at a high enough level to finance the huge and continuing expansion of our industrial machine that is now underway.

Basic Issues

As soon as the amendment was enacted, the President asked Congress to revise the law again. The heart of his proposal was to restore to the Administration the powers it used last spring to arrange the squeeze on profits outlined here.

This controversy will continue. There can be no final answer to it as long as we have the economic controls made necessary by mobilization.

But if we look beneath the surface of this technically complicated controversy, we shall see clearly that the basic issues are:

1. Whether we really shall make an effort to distribute fairly the burdens of inflation caused by our defense mobilization—

2. Whether farmers and organized workers should be exempted from these sacrifices by escalator clauses—at the expense of the nation as a whole—

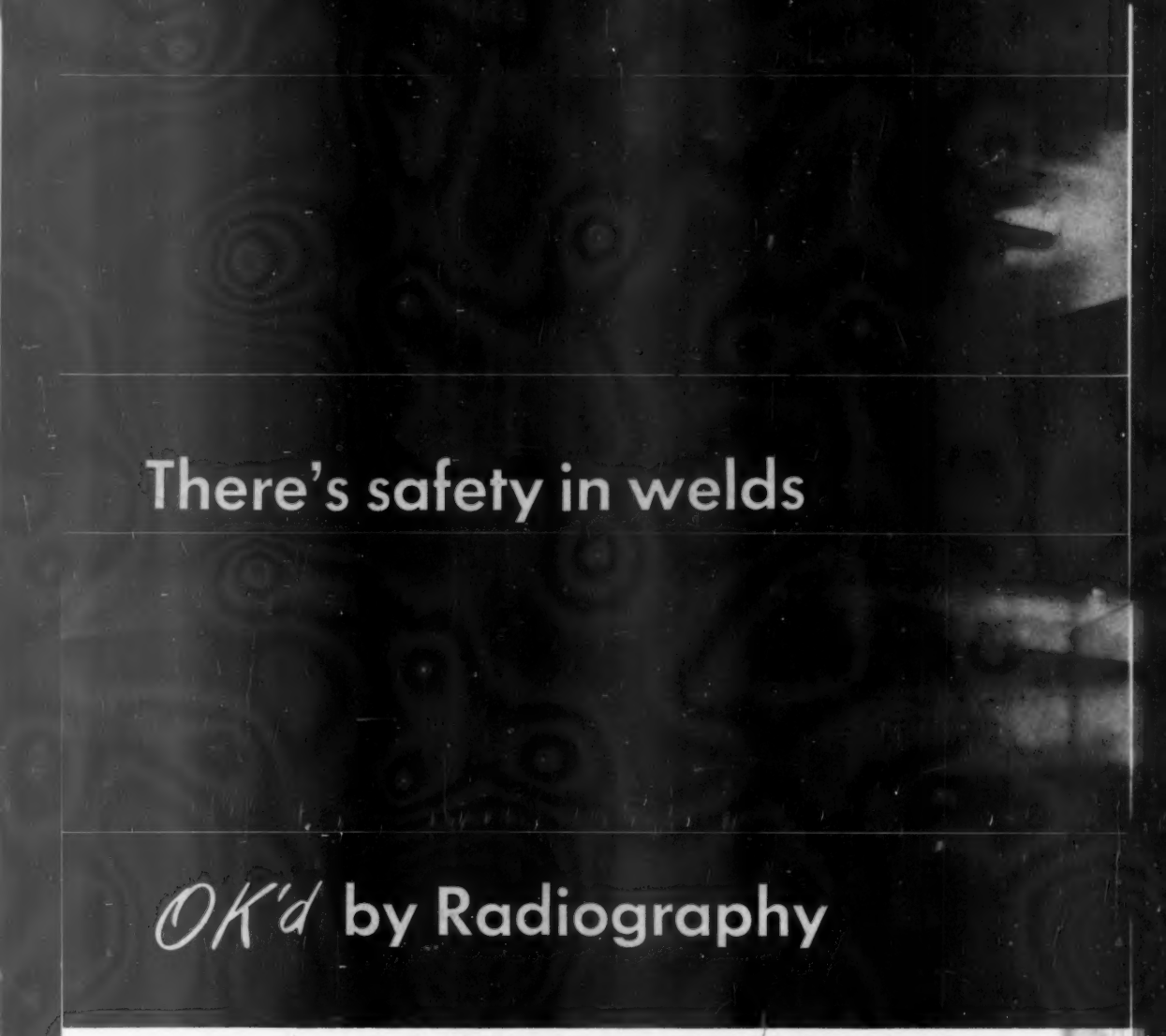
3. Whether profits should be squeezed still more—at the risk of putting a fatal squeeze on the effort of industry to build new plants and install new tools. These new facilities are essential to maintaining American living standards—and they are the heart of our ability to defend ourselves and the rest of the free world.

Americans face no more important economic issues at this time.

McGraw-Hill Publishing Company, Inc.

There's safety in welds

OK'd by Radiography



Radiographs showing welds in gas tanks. Lower radiograph shows acceptable tank weld.

These radiographs show the welds in propane gas tanks. The upper discloses a lack of fusion and heavy gas porosities. Out of a lot of several hundred tanks, Radiography showed a dozen to be hazardous—twelve potential accidents that were prevented.

Because Radiography can prove the soundness of welds it is opening new fields to welders in manufacturing pressure vessels and in other applications where welding was once barred, it is now an accepted procedure.

This is why Radiography can help you build your business as well as earn a reputation for highly satisfactory work.

If you would like to know more about what it can do for you in your own work, discuss it fully with your x-ray dealer.

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X-ray Division
Rochester 4, New York

Radiography...

another important function of photography

Kodak
TRADE-MARK

on the job

Courtesy The Pandjiris Weldment Co.

BIG GEAR is 23 ft 5¾ in. in diameter and has 352 teeth, each shaped to the form of an involute curve

Courtesy Air Reduction Sales Co.

SIMULTANEOUS WELDS to join the sections of the tubular aluminum mast are made by inert-arc metal-arc

Flame-Cut 24-Ft Gear

(Top left picture)

A GEAR that measures 23 ft 5¾ in. in finished diameter and has a face 6 in. wide was flame-cut from 6-in. steel plate at the Pandjiris Weldment Co., St. Louis. It wasn't any easy task!

Pandjiris engineers decided that the simplest way to do the big job was to produce 16 separate segments that could be bolted together to form the rim of the gear. To make up the 74-ft circumference, each segment had to be 3 ft 7 in. long. Producing serrated steel sections that will fit together in a near-perfect circle is hard enough under any circumstances, but the specifications called for still another stickler. The shape of each of the 352 teeth was to be a generated involute curve!

An involute, in case you would like to know, is the curve that is traced by any point on a thread that is kept taut as it is wound or unwound from another curve. Designers use involute-curved gear faces for an excellent reason: they produce a rolling action when mating teeth intermesh. Flat-faced teeth, though far simpler to cut, slide and butt against each other with a great deal of friction and noise. On this extremely large gear, the cutting of involute teeth would save the purchaser many dollars in power requirements and gear maintenance.

First step was to produce a master gear-tooth segment of extreme accuracy. This provided the guide for the magnetic tracer on the flame-cutting apparatus (see center of gear in picture). Before cutting, the 6-in. steel slab from which a segment was shaped was furnace-preheated to 600 F, then immediately locked in a special jig. Preheat was kept at 600 F by manual torches during the cutting in order to maintain perfect pitch (pitch is the distance between identical points on adjacent gear teeth). The edges produced on the teeth were so smooth that little finish work was left to be done by machining.

The big gear is now turning a 90-ft diameter table in a primary metals-producing plant at speeds ranging up to 300 feet per minute.

* * *

Aluminum Destroyer Masts

(Top right picture)

LIGHTWEIGHT welded aluminum masts, rising above the decks of destroyers to the height of an 8-story or 10-story building, are being constructed and installed at Navy shipyards scattered throughout the country. The first of these masts was fabricated in the Boston Naval Shipyard about a year and a half ago.

Every pound of superstructure weight saved permits additional weight of radar and other operating gear to be mounted aloft. Hence the big advantage of using aluminum masts is obvious. The masts are fabricated on a production schedule calculated to take advantage of the speed of the inert-arc metal-arc process using consumable electrodes. As the welding time is usually much shorter than the time required for the basic overhaul, it is seldom necessary to delay a destroyer in the yard while the mast is being fabricated. As a result, much shorter scheduling and faster overhaul time are possible than would be the case if older (and slower) welding methods were used.

Though design details vary from class to class of vessel, the basic structure is generally similar. The mast consists of a tripod frame carrying one or more platftorms, which is tipped by a stub mast carrying still another platform. The legs and bracing members are of heavy-wall aluminum tubing, some of which is extruded and some welded from rolled plate. The platforms are built of plate and shapes with stiffening members.

As employed in naval shipyards, the inert-arc metal-arc process uses a welding "gun," through which a bare aluminum wire is fed continuously to the gas-shielded arc. Direct current (reverse polarity) of relatively high amperage is employed. Because of the high current density, burn-off and deposition rates are high, and the metal transfer created permits welding to be done in all positions.

The efficiency of the process is high since there is no electrode changing, no fluxing nor flux removal and no interpass cleaning. Practically 100% arc time is available. Moreover, comparatively few passes are needed because of the large amount of filler metal that can be put down in a pass. The high rate of hourly production achieved is said to more than balance the cost of the specially drawn and prepared electrode wire and the shielding gas from the standpoint of economy.

Thin material down to ⅛ in. can be welded with smaller-diameter wire and lower currents. The efficiency is comparable to heavy work.

Courtesy Linde Air Products Co.
FINISHED SHIELDS for studs are on the left of the jig for cutting

Cutting out Stud Shields

E. T. HAZELDINE Machine Co., Terre Haute, Ind., has developed quite a business making stud shields for defense plants that want to avoid difficulties in moving heavy machinery. The shields, made from steel pipe, are placed over studs sunk in concrete floors to protect the stud threads while heavy pieces of machinery are being lowered onto the studs. Before the shields were designed, much time was lost in ripping out damaged studs from the concrete and replacing them.

The stud shields are fabricated in a jig with a flame-cutting machine as shown in the picture above. Four cuts are made in each piece of pipe, the operator turning the pipe after a cut has been completed. The cut pipes are then heated and shaped like the sections shown at the left of the jig. Finally, the cuts are welded and the shield interior is partially threaded to screw over the stud.

* * *

Arc-Cutting Bronze Risers

CUTTING OFF the risers from large bronze castings often presents a tough problem to the foundryman. An Australian firm, P. S. Yallop, of Melbourne, found an interesting solution to overcome the difficulties presented by clamping and manipulating awkwardly shaped castings.

Yallop was confronted with the problem of removing risers having a 6 by 3 in. cross-section from castings for very large bronze bearings. The firm lacked machinery of sufficient capacity to do the job by mechanical sawing, so it was decided to try arc cutting.

The workers used 5/16-in. electrodes that had been soaked in water for half an hour prior to use. To cut off each riser took 10 to 12 feet of electrodes. A very successful job was done: time 4 minutes per riser.

—McGraw-Hill World News

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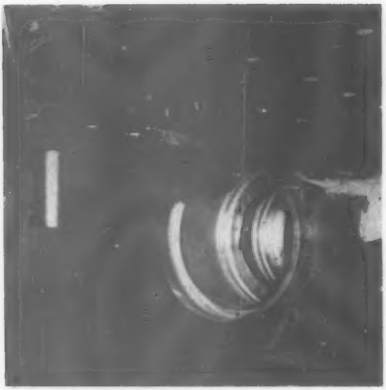

GIANT TIP tanks for aircraft are welded in big seam welder having 60-in. throat depth

WATCHING RAIL WELDING in EJ & E yards at Joliet, Ill., are 180 roadmasters. The men also watched laying of a 1,600-ft rail

NEWS

Welded Seatrain Ship Joins Gulf Service

LATEST addition to the Seatrain Lines fleet of ocean-going freight-car carriers is the *Seatrain Georgia*, built by the Sun Shipbuilding & Dry Dock Co., Chester, Pa. An all-welded vessel of 8,300 tons gross displacement, she can carry 100 freight cars and 12,000 barrels of liquid cargo in deep tanks. The *Georgia* is 503 ft long and 63 ft 5 in. wide.

Route of the Seatrains is between Edgewater, N. J., and New Orleans and Texas City, Tex. A round trip is made in two weeks. Freight cars are swung aboard by special cranes, rolled into place and secured so they are immovable in the roughest seas. All 100 cars can be loaded aboard or discharged in five hours, says Seatrain Lines.

* * *

Big Seam Welder Makes Biggest Aircraft Tanks

THE largest external aircraft fuel tanks in production today are made on a giant seam welder at Ryan Aeronautical Co., San Diego. The welders in use for this job can be used either as spot, roll-spot or seam welders.

Size of these tanks can be seen above (left photo) compared to the 60-in. throat depth of the welder. These mammoth tanks are fabricated from aluminum sheet without external riveting or protuberances of any kind. All seams are welded and are certified gas-tight without the use of sealing compounds.

Capacity of the welder shown in the picture is two sheets of either 0.125 in. aluminum, 0.153 in. austenitic stainless or 0.281 in. carbon steel. Another large welder in use at Ryan has a throat depth of 48 in. and will weld two thicknesses of 0.102 in. aluminum.

A welcome feature to Ryan engineers using the seam welder is a continuous dressing device, which keeps the wheel in perfect contour. The upper electrode wheel swings out away from the work, permitting a quick change in set-up. An idea of the size of the welder can be conveyed by saying it develops 105,000 amp of current on short circuit and has a maximum electrode pressure of 9,100 lb.

* * *

D-C Welders Dry Flooded Motors

AN UNUSUAL task was set for d-c welders to restore a meat plant to service after the recent Kansas City flood. The welders were hooked up to the windings of large electric motors to dry them with welding current. Hot air heaters near the windings carried the moisture away. To hold the heat, each motor was covered with tarpaulins. This unique way of getting motors back in service was thought up by 22 engineers from the engineering and service department of the Westinghouse Electric Corporation jet engine plant at Kansas City.

* * *

180 Roadmasters See Continuous Rail Welding

MORE than 180 members of the Roadmasters Association made a field trip on Sept. 19 to the Elgin, Joliet and Eastern railway yards near Joliet, Ill., to see how continuous welded rail is produced. On the same field trip, the roadmasters saw a gang numbering only 41 men replacing 39-ft. rails with ones 1,600 ft long.

The visitors also saw two 19,812 ft rails that were laid by the EJ & E recently. They are thought to be the longest in the world. The EJ & E, incidentally, has more welded continuous rail than any other in North America.

At the rail welding site, the roadmasters saw the pressure-welding machines joining 39-ft sections. The visitors were guests of Oxweld Railroad Service Co. as well as the "J" railway.

* * *

New Hobart Distributor for Northern New Jersey

E. W. EVANSON, president of Hobart Welding Equipment Co., 155 Washington St., Newark 5, N. J., will direct the new Hobart distributorship for northern New Jersey. A complete line of welding equipment, service, parts, electrodes, accessories and power plants will be handled.

Cadmium-Plated Metals Dangerous to Weldors

THE widespread use of cadmium as a plating material requires constant alertness on the part of weldors, warns Walter H. Poppe, Jr., Industrial Hygiene Division, Wisconsin State Board of Health, in an article, printed in the August issue of the *Industrial Health Monthly*. The article tells of two deaths in Wisconsin in 1951 due to inhalation of cadmium fumes.

A good electroplating metal, cadmium produces a silver-white coating that takes a high polish and protects the base metal from corrosion.

Trouble starts when a welding torch or an electrode hits the cadmium layer and it starts to melt. The fumes are poisonous, as attested by one Wisconsin death of an oxyacetylene weldor who was burning off a cadmium salt coating on a tank used for cadmium plating. A second weldor died after spot welding cadmium plated steel.

If the extremely toxic nature of cadmium fumes had been appreciated proper local exhaust ventilation or approved respirators would have been used, the men probably wouldn't have been hurt.

Spot checks to determine whether or not a piece of metal is coated with cadmium or zinc can be made with either a welding torch or a chemical solution. With the torch, an operator slowly heats the object in question. If cadmium-plated, it will form a yellow-gold film; if zinc-plated, the film will be smoky dark gray. The chemical method employs a drop of concentrated hydrochloric acid on the questioned surface. After a few seconds, a drop of ammonium hydroxide saturated with hydrogen sulfide is deposited on the first drop of acid. A bright yellow precipitate will indicate the coating is cadmium, while a white precipitate will indicate a zinc coating.

A good rule for weldors who might handle cadmium: Don't trust box labels for the type of plating, since even some factories confuse zinc and cadmium plating appearances.

* * *

Lucas-Milhaupt Opens Silver-Brazing Consulting Service

A NEW Chicago office of Lucas-Milhaupt Engineering Co., Cudahy, Wis., will offer a national consulting service on silver-brazing problems. In addition, the company's notched-coil silver brazing rings and coined washers will be sold from this office by Chicago manager Harlan Olson. Offices will be at 333 North Michigan Ave.

Putting The Squeeze On Production Losses With Bridgeport's No. 192 Low Fuming Bronze Rod

This cylinder for a hydraulic squeeze pointer was repaired by braze-welding with Bridgeport's No. 192 Low Fuming Bronze and was soon back on the job. It has been working almost continuously ever since because the repair was both strong and tough.

Check these advantages of Bronze Welding:

1. No high preheats, slow cooling or elaborate repair set-ups are needed. Break is cleaned and properly prepared, then heated only to redness.
2. Excellent "tinning" and "filling" action assures a strong bond. Built-up surfaces renew the life of worn-out equipment.
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Write for "Bronze Welding Alloys" booklet. In its 24 pages you'll find valuable information on braze-welding. Please send your request on company stationery.

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Harnischfeger Starts National Service Week

To make the users of its equipment realize the need and value of proper and timely maintenance work, Harnischfeger Corporation, Milwaukee, and its 700 dealers, branches and warehouses, observed a National Service Week from Sept. 15-21.

Each sales outlet for P&H equipment carried out a well-planned program in its area to point up the service theme. A special emblem for windows, trade literature and letterheads was devised. Other steps aimed at making National Service Week significant even included providing the owner of P&H equipment with a number of suggestions to help him keep it in good condition. Also on the program were the training of additional service personnel and the stocking of larger quantities of replacement parts in P&H branches and warehouses.

"We cannot over-emphasize the need for proper maintenance these days," said Mr. Henry Harnischfeger, vice-president of the 67-year-old firm. With raw materials on allocation and so much of available production going to fill government contracts, there just won't be enough to go around, he reminded.

Anticipating the need for larger stocks of parts, the company has diverted a sizable proportion of its production facilities during the past year to the manufacture of those items most likely to be needed as replacement parts. Reserve stocks in P&H warehouses are three times what they were a year ago, say company officials.

* * *

Reynolds Metals Movie Tells Story of Aluminum

A PICTORIAL tour through the Reynolds Metals aluminum extrusion mill at Phoenix, Ariz., is made in the new 16-mm, full-color movie, "The Shape of Things to Come," just released for free showings to technical societies, schools, colleges and other interested groups.

The film shows how an aluminum billet is heated to soften it, then put in a huge hydraulic press where millions of pounds of pressure cause the metal to flow out through a die opening of the size and shape wanted for the extruded part. Pictures of extruded parts fabricated for service in buses, cameras, building products, trucks and trailers, textile machines, store fronts, bridge railings, pipe lines, etc., are woven into the story.

For bookings, write the motion picture department of Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

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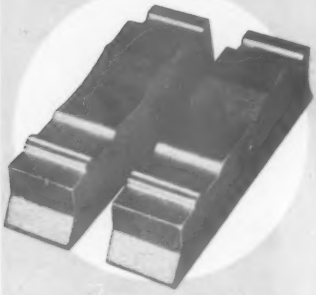
The DIE is CAST —to Size



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WM-4

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SQUARE SHEAR moves from old Lincoln Electric plant to new site

Lincoln Moves Factory at Slight Production Loss

EFFICIENT transfer of production machinery to its new St. Clair Avenue plant in Cleveland cost The Lincoln Electric Co. only 10% of its monthly production. Moving was completed the week end of Sept. 15-16 for all executive and plant offices with equipment. More than 1,500 machines and many tons of raw material were shifted during the 20 working days needed for the plant proper.

Pinpoint planning made the move a smooth operation, with production on each machine picking up at the new plant a few hours after stopping at the old. Raw material was moved out first while machines at the old plant were kept operating on the work already in process.

Basic machines such as shears and presses ran out of work first and thus were moved first to the new location, where raw material had previously been stocked. When the machines used in the latter stages of welder construction arrived at the new plant, they had stocks of material waiting.

Operators were moved with their machines. Each operator saw that his machine was washed and cleaned, that all tools and equipment was packed and labeled and that the old floor area was swept. At the new plant, each employee's stock of raw materials will be kept alongside his machine for maximum efficiency. Raw materials from outside sources arriving at the plant will go directly from railroad car or truck to the area where they will be processed.

The new plant is located on a 68-acre tract of land and contains 860,000 sq ft of floor space compared to 500,000 in the old plant. The added floor space will be occupied by the new storage spaces alongside the machines, not by an increased labor force.

TIME is MONEY

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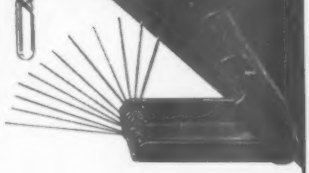
are guaranteed unbreakable. They do a cleaner, smoother job because the new spiral design prevents carbon and slag from jamming in the orifice and eliminates breaking of the cleaner when cleaning tip.



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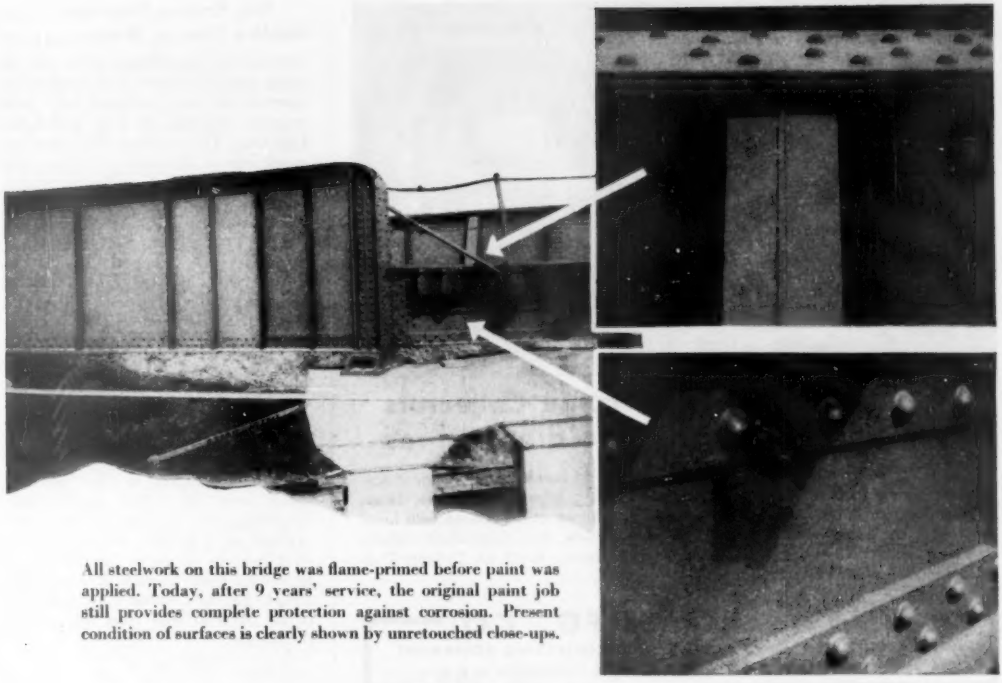
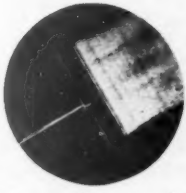
NEWARK CHICAGO LOS ANGELES



All steelwork on this bridge was flame-primed before paint was applied. Today, after 9 years' service, the original paint job still provides complete protection against corrosion. Present condition of surfaces is clearly shown by unretouched close-ups.

Your Steelwork . . .

How Will It Look in 1960?



Steelwork you coat with good paint today can still look like new ten years from now, *if you flame-prime all exposed surfaces first.* And what you'll save on maintenance, because of increased protection due to flame-priming, will more than pay for all the flame-priming apparatus and materials you need for the job.

Flame-priming is simple to do, requires little equipment, and costs little. A brush of oxy-acetylene flames pops off scale and drives out moisture. Paint applied to the warm, dry surface goes on quickly and smoothly, bonds tightly, and lasts longer.

Flame-priming is one of many time- and money-saving LINDE methods for making, cutting, joining, treating, and forming metals. So, whatever you do with metals, there is a good chance that LINDE know-how, show-how, and equipment can help you do it better, more quickly, or at lower cost.

To find out, without obligation, telephone or write our nearest office today. LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in Other Principal Cities. In Canada: Dominion Oxygen Company, Limited, Toronto.

Linde
Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, AND FORMING METALS

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

Group of RUEMELIN Fume Collectors Keeps Shop Clear of Welding Fumes

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes at the source with local exhaust hoods has proven most practical in operation. It is particularly helpful in winter months when doors and windows are closed. Write for Bulletin 37-D describing all types of Ruemelin Fume Collectors.

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

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Feeling low about the steel situation?

Let us try to help you! Very frequently our experience will suggest a way out of your particular steel supply difficulty. We may have substitute materials or know of ways to stretch the supply of steel available to you. Call us *first* when you have a steel problem.

UNITED STATES STEEL SUPPLY COMPANY

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Headquarters Offices: 208 S. La Salle St.—Chicago 4, Ill.

USS

UNITED STATES STEEL

New Process Forecasts Engines Run on Water

SEPARATION of ordinary water into its component hydrogen and oxygen for commercial uses is claimed for a new process invented by two Salt Lake City men. The cracking unit uses low grade oils or kerosene as a fuel, but inventors William G. Daugherty and George W. Jackson won't tell the other details.

The Utah Hydro Corporation, a subsidiary of General Investment Corp., Salt Lake City, will develop and market the invention. William E. Huyler, San Fernando, Calif., is president, Jackson and Daugherty are directors of Utah Hydro and Ilan Jacobs is secretary-treasurer of both corporations.

Prospective uses for the process, according to Utah Hydro, include cracking water to obtain large quantities of hydrogen, in turn used to refine iron ore. Other applications contemplated include using the cracker as a booster on oil, gas or coal heaters or as a supply for a hydrogen blast furnace. To look far ahead, perhaps water may turn out to be the fuel that runs the car of the future.

* * *

Philips Company Holds X-Ray Diffraction School

NORTH American Philips Co., Inc., held its 11th X-ray diffraction school at the company's plant in Mt. Vernon, N. Y. from Oct 8-12. The schools are semi-annual affairs, held usually in April and October. Scientific personnel from industry have been enrolling in increasing numbers since the schools were begun.

"Play it pianissimo, huh? Fortissimo causes weld cracks!"

New York NWSA Meeting Attracts 90 Delegates

EASTERN zone meeting of the National Welding Supply Association, held Sept. 25 at the Hotel New Yorker, New York City, opened the new year with success. Distributors and manufacturers in attendance numbered 90 hailing from all over the eastern part of the country. Robert C. Waldie, Williams & Co., Inc., Pittsburgh, eastern zone vice-president, was in charge.

Eight companies signed applications for membership at the meeting: Delta Oxygen Co., Baltimore; General Welding Supply Corp., Mineola, N. Y.; Hampton Roads Welders Supply Co., Norfolk, Va.; Jersey Welding Supply, Inc., Plainfield, N. J.; Eastern Welding Equipment Co., New York City; J. W. Goodliffe & Son, Linden, N. J.; Interstate Welding Supply Corp., Elizabeth, N. J., and Fred C. Archer, Inc., Milwaukee 3, Wis.

The morning session was taken up with a roundtable discussion on business conditions and the effect of the defense program. All reported that NWSA bulletins and synopses of the NPA and OPS regulations helped them in their operations.

Only formal discussion of the morning was by J. W. Albiston, Maine Oxy-Acetylene Supply Co., who talked on the advisability of setting quotas for salesmen.

An address on ledgerless bookkeeping was given after lunch by Thomas D. Ryan of Remington-Rand, Inc., New York. Several NWSA members have this system established and reported on their experiences.

Myron D. Miller, secretary of the Steel and Iron Panel, Commerce and Industry Association of New York talked on developments in connection with the revision of the New York City welding code. This panel has been trying to get several bills passed that would make the New York area more attractive to the welding distributor.

J. W. Fenstermacher, Mitchell Welding Supply Co., Scranton, Pa., discussed the values of an incentive program for his employees. Next speaker was Carl W. Berner, Welders Supply, Philadelphia, who talked on the small order problem confronting welding supply distributors.

R. P. Mahony, Albany Welding Supply Co., Albany, N.Y., concluded the formal program by leading a talk on the importance of keeping up with new developments in the industry, such as new products or modifications. It was suggested by one member that fine sources of news on the welding industry are the trade magazines covering that field.

WAGNER

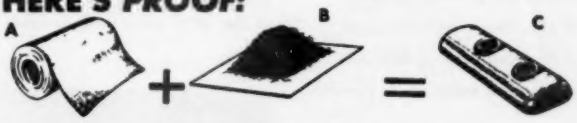
ELECTRODE HOLDERS

WITH *IMPROVED* "COPPERHEAD" INSULATOR TIPS

INSURE ADDED

***ECONOMY* in Welding**

HERE'S *PROOF*:



1st a heavy Woven Glass Fabric, (Fig. A) provides cover protection to insure the impact strength necessary to withstand the shock of dropping and tough operating conditions.

2nd Long Asbestos Fibres, (Fig. B) insure greater protection against radiated heat of the arc, as well as providing impact strength, and adequate electrical insulation.

3rd Plastic Resin of extreme heat-resisting qualities bond "A" and "B"" together to provide protection against high temperatures and pressures, with the result that these improved "COPPERHEAD" Insulating TIPS make the WAGNER ELECTRODE HOLDER the most practical and economical to use.

WAGNER WELDING PRODUCTS *are the result of more than thirty-three years of experience in welding and practical knowledge of mechanical and electrical engineering. WAGNER products are sold only through Welding Supply Dealers, or write us direct for further details.*

WAGNER MANUFACTURING CO.
230 W. 1st SOUTH ST. JACKSON, MISSOURI

Ranite "B-X" Rod

Provides Better Hard Surfacing In Less Time

Ranite "B-X" Rod is a form of the familiar Ranite type "B" with newly developed features to speed and improve your hard surfacing . . . the result of months of research and field tests . . . interchangeable on applications where "B" is now employed at operator's option.

"B-X" Offers You:

- Higher amperage for speed
- Straight polarity for speed
- 25% faster deposition rate
- Reduced welding time
- Less heat induction to parent metal
- Less dilution from base metal
- A-C, D-C operation
- Tougher, harder deposits
- Quiet spatterless metallic coating
- Bonds with manganese, cast iron, steels
- Good forging characteristics
- Increased wearing life

"B-X" is the hard surfacing electrode with a new punch. Don't fail to give it your toughest test. Write for bulletin "B-X".

Rankin Manufacturing Company

3072 West Pico Blvd.

Los Angeles 6, Calif.

G-E Research Scientists To Teach at Rensselaer

METALLURGICAL and ceramic research scientists of the General Electric Co. will serve this year as adjunct professors and lecturers before graduate students at Rensselaer Polytechnic Institute, Troy, N. Y. Contributions of the scientists to the education of graduate metallurgy students will be considerable, declares Dr. Wendell F. Hess, head of metallurgy at the school.

The four G-E scientists who will serve as an advisory committee in organizing additional courses for day and evening graduate students are: Drs. John H. Hollomon, John C. Fisher, David Turnbull and James D. Nisbet. Dr. R. L. Fullman has been appointed as a visiting lecturer at Rensselaer for the coming year.

* * *

Recover Scrap Iron Buried in Ground

BETWEEN 5,000 and 10,000 tons of scrap metal are expected to be recovered from a 115-acre pipe foundry site near Cincinnati this year. Plans to recover the scrap were announced by the manager of Monsanto Chemical Company's new plastics division plant there.

The site had been occupied for nearly 75 years by the U. S. Pipe and Foundry Co. During that time, scrap metal was dumped in various parts of the large plant and covered with dirt.

WELDED PLASTIC tank will hold corrosive fluorides in a new fluoridation system at Avon Lake, O. The vinyl plastic material is the B. F. Goodrich Chemical Company's Geon 404. It is unaffected by alkalies, acids, salts, oxidizing agents, oils, greases, alcohols, gasolines and carbon tetrachloride.

THE
ARC-FIT
PROCESS
Tube notched with special ARC-FIT
Angular notch on tubular member.
Square tube notched to fit square pipe.
Angle joint two pipes.
"T" butch on end of Tubular member.
Pipe Notched with deep slot.
"T" joint on tube or pipe.
Angle iron notched to fit pipe.

TOPS IN SHOP EFFICIENCY

5 seconds to notch Tubing and Pipe Ends

The answer to many problems confronting large and small shop owners. No shop can afford to be without the ARC-FIT—no matter how large or how small. Manual or power operated—fits the ARC-FIT hand press or any standard power press.

ARC-FIT is a patented precision-built shearing tool which prepares the ends of tubing or pipe to produce welded or brazed tubular "T" or angle joints. ARC-FIT will not deform the tube or pipe and no further finishing is required—no sawing, cutting, or removing sections with milling cutters. Our literature gives many fine points on operation, construction, and application—send for it today—also write for quotations.

VOGEL TOOL & DIE CORPORATION

1825 N. 32ND STREET
Dept. W-E
MELROSE PARK, ILL.

Weldor's Leather Clothing Needs Dry Cleaning

SOILED and stained protective chrome-tanned leather clothing should be cleaned by dry cleaning methods, says American Optical Company's safety products department. Dry cleaning does not affect the chromic oxide content of tanned leather, says AO, but the oil or grease content is usually lowered. This oil or grease has to be returned to the leather after cleaning or it will be left stiff and lifeless.

Following are instructions to give to dry cleaners when they are working on your chrome-tanned leather garments: first, place garments in washer and add leather soap to the solvent. Use as low a solvent level as possible and run the washer the minimum time for cleaning. Rinse the garment in a low solvent level and extract lightly. Place the garment in an oil bath until it is thoroughly soaked. Extract until the excess solvent is removed. Next, tumble the garment in cold tumbler until thoroughly dry. When dry, the leather should be brushed.

Badly soiled garments should be brushed by hand with soap and solvent solution before being placed in washer.

• • •

National Radiator Opens Plant at Duncansville, Pa.

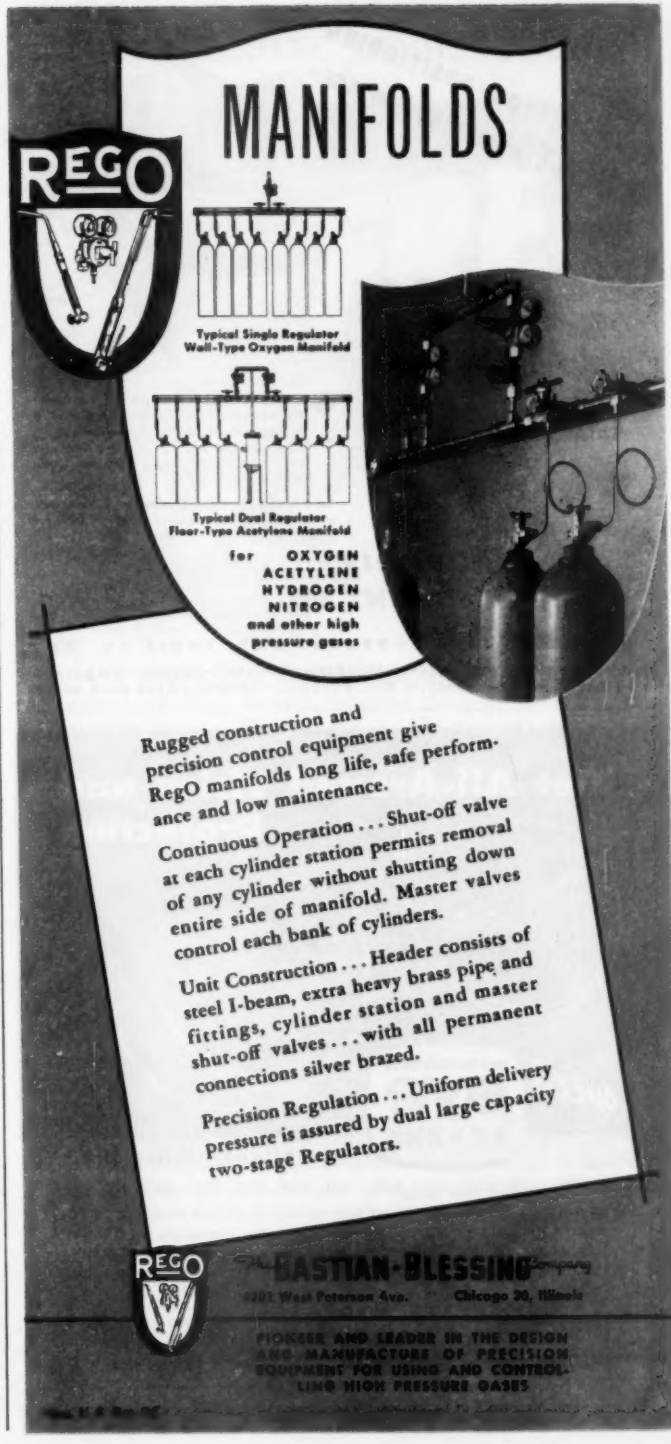
REPORTEDLY one of the most modern sheet metal fabricating plants in the country, the new Duncansville, Pa., plant of The National Radiator Company was opened in October. It is located in the greater industrial district of Altoona, Pa., on a 15-acre plot of ground. The main building is 260 ft wide and 460 ft long.

Nearly $400,000 worth of new machinery and equipment will be installed, in addition to a variety of presses, shears, press brakes, grinders, welders, etc., to be moved from other National Radiator plants.

• • •

New $5,000,000 Addition to American Welding & Mfg. Co.

PLANS for additions to plant and equipment of The American Welding & Manufacturing Co., Warren, O., call for an expenditure of more than $5,000,000. The expansion will materially increase American Welding's output of jet and reciprocating engine parts for the aircraft industry. The company recently received a $3,000,000 order for coated nozzle boxes, turbine casings, exhaust cones and stainless and titanium welded ring applications.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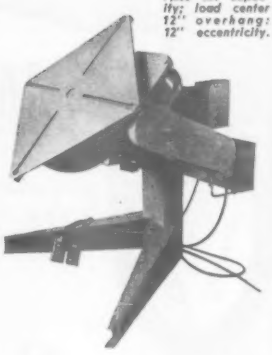
REGO
Typical Single Regulator Wall-Type Oxygen Manifold
Typical Dual Regulator Floor-Type Acetylene Manifold
for OXYGEN ACETYLENE HYDROGEN NITROGEN and other high pressure gases
Rugged construction and precision control equipment give RegO manifolds long life, safe performance and low maintenance.
Continuous Operation . . . Shut-off valve at each cylinder station permits removal of any cylinder without shutting down entire side of manifold. Master valves control each bank of cylinders.
Unit Construction . . . Header consists of steel I-beam, extra heavy brass pipe and fittings, cylinder station and master shut-off valves . . . with all permanent connections silver brazed.
Precision Regulation . . . Uniform delivery pressure is assured by dual large capacity two-stage Regulators.
REGO
BASTIAN-BLESSING Company
Chicago 30, Illinois
PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING HIGH PRESSURE GASES

PUSH BUTTON POSITIONING
BOOSTS WELDING FOOTAGE•

WELDMORE
The
POSITIONER
with
Production
in Mind



Model 7SMYRMT; 7,500 lb. capacity; load center 12" overhang; 12" eccentricity.

● At any rotation speed—at any elevation—the new Weldmore boosts production by making easy all awkward position welding. Table rotation and tilt fingertip controlled. 135° table tilt with safety limit stops. Impact loading minimized for safety.

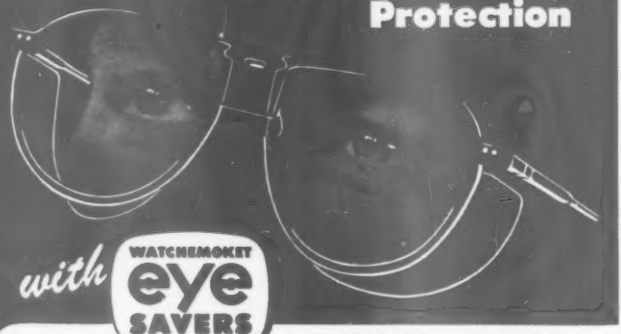
Send for complete specifications on this and other models, having capacities of 3,000; 18,000; and 25,000 lbs.

PANDJIRIS
WELDMENT CO.

5151 NORTHRUP – ST. LOUIS 10, MO.

WELDING GANTRIES—WALL TRACK PLANOGRAPH WELD ARMS—TURNING ROLLS—TANK JIGS—TUBE BENDERS—HYDRAULIC COIL MANDRELS—SPECIAL POWER WELD TOOLS

Get All-Around Vision and Protection



with WATCHEMOKET eye SAVERS

TUC-AWAY WELDER'S GOGGLE

Here's the ideal flash goggle for under-helmet use and other glare and impact hazards! Each Tuc-Away lens and side shield is a one-piece plastic unit providing wide-angle vision and *sure* eye protection. 3 different "change-around" lens units are available for various types of eye hazards. Exclusive Retrax "telescoping" temples assure perfect fit and comfort. Order from your welding (or safety) supplier or write direct.

FREE! *Send for magazine article giving impartial advice on best uses of plastic eye protection. Eye-Savers catalog also included.*

WATCHEMOKET OPTICAL CO., INC. DEPT. 5, PROVIDENCE, R. I.

Producers & Originators of Practical Plastic Eye Protection

SIMPLIFIED timer for Ryan spot welders made by Ryan repairmen

Simplified Sequence Timer Developed for Spot Welding

Two electrical maintenance men at Ryan Aeronautical Co., San Diego, Calif., have worked out a compact, simple type of sequence spot-welding timer. Eddie Duke and Bill Phillips, its makers, claim that it is more trouble-free than commercially available panels and also easier to service.

The timer can be used on either single-phase or stored energy type welders by installing a jumper wire. Ryan officials think that this standard panel for a number of machines will greatly simplify any maintenance tasks. In the past, a spot welder has been idle for as long as 48 hours while sequence panel wiring layouts were being checked for trouble. Should major repairs be necessary, the entire timer can be quickly removed and a spare installed with plug-in connections.

With the new panel, the welding sequence is automatic after being initiated by the operator's foot switch. Once started, the operator cannot alter any element of the sequence since each relay locks itself in.

* * *

Westinghouse Man Wins $750 RWMA Prize

W. LESLIE ROBERTS of the Westinghouse Research Laboratories won the $750 award sponsored by the Resistance Welder Manufacturers' Association this year. The award was made to Mr. Roberts at the annual dinner of the American Welding Society in Detroit Oct. 18.

A native of England, Mr. Roberts attended Cambridge, where he received both his bachelor and master's degrees. During the war he aided in developing the "Oboe" radar bombing system. He came to the United States in 1947 to work for the Federal Telecommunications Laboratories.

100 Farm Welding Prizes Awarded by Lincoln

WINNERS of the first nation-wide welding award program for agricultural high school students are announced by The James F. Lincoln Arc Welding Foundation, Cleveland. Amounts of the awards ranged from $600 to $25 and the 100 winners were from 31 states.

To honor further the first 10 main award winners, their high schools received duplicate awards to be used for improvements in shop mechanics' courses.

Stan Reifel of Ontario, Calif., won first prize of $600 with a description of a welded horse trailer worth at least $1,000 which he built for only $305.

Raymond Lubracherie, San Jose, Calif., won the second award of $400 for an account of a welded "cattle squeeze." Jack Seitzinger, Vincennes, Ind., and Ronald Pourroy, San Martin, Calif., won third awards of $200 each.

Purpose of the awards, says the Lincoln Foundation, is to encourage farm boys to study methods of becoming more self-sufficient in farming operations by the use of welded carts, wagons, saws, feeders, and loaders.

Judges were E. E. Dreese of the department of electrical engineering at Ohio State University; O. E. Kiser, State Supervisor of Agricultural Education, New Jersey; A. H. Hollenberg, Specialist in Farm Mechanics, U. S. Office of Education, and Ray Morrison, VoAg teacher, Clay Center, Kans.

• • •

Weldit Named Distributor for Tipaloy R-W Products

WELDIT, INC., 990 Oakman Blvd., Detroit 6, has been appointed national distributor for Tipaloy resistance-welding electrodes. P. R. Bierer, vice-president of Tipaloy, Inc., Detroit 11, announced the appointment after he had completed arrangements with Otis L. Smith, Weldit president. The Clifford L. Schueltz & Co., 4637 North Knox Ave., Chicago 30, has been named Chicago area distributor for the Weldit gas welding equipment and Tipaloy resistance welding electrodes.

• • •

Safety Clothing Maker Moves

THE Safety Clothing & Equipment Co. is in its new factory and offices at 1990 East 65th St. in Cleveland, O. Makers of "Gardwell" brand safety clothing, gloves, leggings, aprons, etc., their former address was 7016 Euclid Ave.

this new WELDING DESIGN MANUAL

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FOR THE ASKING

To assist you in your re-tooling problems . . . or to help you analyze your present welding methods so that you may enjoy maximum speed, efficiency, and economy in many of YOUR production problems . . .

Over 40 pages of helpful data covering basic and advanced welding techniques and designs used in fabricating and assembly. Profusely illustrated with scores of application drawings; weld diagrams; tables containing latest information on melting temperatures, tensile strengths, corrosion factors; charts; alloy recommendations; etc. Convenient digest size.

This just-off-the-press book is "must" reading for anyone engaged in defense production and design, and will certainly be time profitably spent for any production man.

SEE . . . The unbelievable savings in metal-joining which can now be yours through the use of "Low Temperature Welding Alloys"® discovered a few years ago and now used in over 78,000 industrial plants throughout America for more efficient metal-working production as well as for salvaging irreplaceable tool and machine parts.

Over 100 different, new, EUTECTIC Low Temperature WELDING ALLOYS® and EUTECTOR® Fluxes are job-engineered for use on ALL metals — cast iron, alloy steels, aluminum, copper and nickel alloys, die castings, overlays, etc., and may be applied with ALL heating methods — torch, arc, furnace, induction heating, etc.

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This new manual of yours sounds like a very helpful book. Send me a FREE copy with the understanding that there will be no cost or obligation now or later.

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"Bronze-Facing" with Ampco* Electrodes Saves $4800

4-ton turbine runner "Bronze-Faced" with Ampco Electrodes.

Cavitation and erosion caused severe wear on the buckets and blades of this large 4-ton turbine runner. A new runner costs $6000. "Bronze-Facing" with Ampco Electrodes cost only $1200 — a savings of $4800!

Better Than New!

"Bronze-Facing" with Ampco Electrodes is used throughout industry to increase service life, provide superior bearing qualities, obtain improved resistance to wear and keep costs down . . . production up.

You too can save time and money by using Ampco Electrodes in your repair and maintenance operations. Get a supply today from your Ampco distributor, or write us.

Power company personnel preparing turbine runner for "Bronze-Facing" with Ampco Electrodes.

W-114

AMPCO

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Milwaukee 46, Wis.
West Coast Plant, Burbank, California
It's Production-Wise to Ampco-ize!
*Reg. U. S. Pat. Off.

66 Special Welders in New Solar Aircraft Plant

THE trend from hand manufacture to mass production of jet engines is shown by the extensive installation of welders, machine tools and conveyors in the new Wakonda plant of Solar Aircraft Company in Des Moines, Ia.

Some 50 resistance welders and 16 fusion welders will be used in the Wakonda plant. The number of welders in this and the Grand Avenue plant of Solar's tops 200, forming the largest bank of welders in any aircraft plant.

Only recently, according to Alexander Black, Solar vice-president and manager of Des Moines operations, has the jet plane emerged from the experimental stage to a volume production item. Manufacture of all volume parts—combustion chambers and transition liners—will be as completely mechanized as possible.

The Wakonda plant will contain about 45 mechanical and hydraulic presses, ranging from 60 to 1,000 ton capacity. About $500,000 worth of heat treating furnaces will be installed for treating stainless at heats up to 1,950 F.

Area of the new plant is 300,000 sq ft and it is located on a 68-acre tract. Its walls are formed of 347 prebuilt panels of 6-in. reinforced concrete.

* * *

Metal Removal Company Moves into New Building

GENERAL offices and research laboratories of the Metal Removal Company, Chicago, have been moved to 1546 North Orleans St. Design ideas for the new structure were worked out by Charles E. Davis, president of Metal Removal. The Spanish-type court and patio are distinctly different from the other industrial buildings.

A large display room houses display stock of the company's adhesive-backed abrasive discs, mounted wheels, carbide and high-speed rotary files, carbide and mills and die and mold finishing specialties.

Bigger production facilities will provide for more output of the company's products this year including segments and abrasive wheels in resinoid, vitrified and rubber bonds.

* * *

All-State Commended for Business Expansion

ALL-STATE Welding Alloys Co., White Plains, N. Y., was recently honored by a resolution voted by the White Plains Chamber of Commerce on the opening of its doubled factory area.

Tempilstik°

the amazing Crayons that tell temperatures

A simple method of controlling working temperatures in:

- WELDING
- FLAME-CUTTING
- TEMPERING
- FORGING
- CASTING
- MOLDING
- DRAWING
- STRAIGHTENING
- HEAT-TREATING IN GENERAL

It's this simple: Select the Tempilstik° for the working temperature you want. Mark your workpiece with it. When the Tempilstik° mark melts, the specified temperature has been reached.

$2

gives up to 2000 readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

Also available in pellet or liquid form

FREE —*Tempil° "Basic Guide to Ferrous Metallurgy"* — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

BOOTH C-117
NATIONAL METAL SHOW
DETROIT, OCT. 15-19

Tempil° corp.
134 WEST 22nd STREET
New York 11, N. Y.

BANNER'S new Milwaukee plant doubles output of spot welders

Banner Manufacturing Occupies Enlarged Plant

BANNER MFG. CO., Milwaukee, a leading Wisconsin manufacturer of resistance welding equipment, is now operating in its modern brick and steel plant at 6820 North 43rd in Milwaukee. It is built on a three-acre tract of land.

David V. Uihlein, owner of Banner, reports that the increased capacity will result in an expanded line of welders at higher production rates.

Known formerly as Banner Products Co., the firm was founded in 1945 by J. R. G. Harris and Arthur Kranitz, both of whom are still with the organization. In 1948 Mr. Uihlein took over operations and the name was changed to Banner Manufacturing Co. Operations then were carried on in a small plant on North 29th St. Increased business soon made a larger building desirable, however.

* * *

Eutectic Doubles Cash Prizes to $2,000 for New Contest

A GRAND total of $2,000 in cash awards, double that of the previous year, plus a considerably increased scope of competition will be offered to weldors this year in Eutectic's 1951-52 "Prize Competition and Program of Awards."

The new competition has two categories: one for papers on welding engineering and theory, the other on practical welding applications. Subject matter of papers in either category must include technological, research, or application aspects of the use of lower melting filler metals in the non-fusion welding processes.

The contest is open to engineers, metallurgists, researchers, teachers, weldors and students. A total of 30 cash prizes will be awarded in the two categories, first prize being $500.

Contest rules, entry blanks and other information will be sent on written request to Eutectic Welding Alloys Corp., Dept. P, 172nd St. and Northern Blvd., Flushing, N. Y.

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LOW TEMPERATURE
BRAZING ALLOYS
SIL-BOND
A SILVER ALLOY...FOR THE STEELS
NEWLY DEVELOPED...VERY LOW COST
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AND
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AT YOUR WELDING SUPPLY JOBBERS
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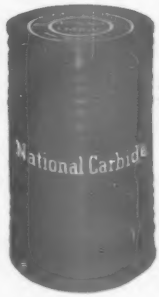

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Tippy Says: CATHERINE THE GREAT WAS A DISH TO BEHOLD . . . ON HER WELDED TRINKETS HER BEAUX WERE SOLD !

Catherine wanted the finest, and her boy friends saw that she got just that. NOW . . . here is your opportunity to see that your plant has the finest resistance welding electrodes . . . TIPALOY! TIPALOY Resistance Welding Electrodes, are fabricated with care to give longer life, and to cut your production costs . . . why not buy the finest . . . buy TIPALOY!

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Write today for test samples and "the story of STRAIGHT LINE conductivity!"

Tipaloy INC. 1435 EAST MILWAUKEE DETROIT 11, MICHIGAN

No. 6 of a Series

Branches in all Principal Cities

About People

JOHN J. CHYLE, director of welding research at A. O. Smith Corp., Milwaukee, gave the Adams Lecture at the annual convention of the AMERICAN WELDING SOCIETY last month in Detroit. He joined A. O. Smith in 1925 and in 1926 was named head of electrode research and in 1936 to his present post. He developed the first extruded all-position type electrode in 1927. His work includes extensive welding development on low alloy high tensile steels, armor welding, large aircraft bomb production and atomic energy production.

* * *

HARLAN OLSON will open a Chicago sales office for Lucas-Milhaupt Engineering Co., Cudahy, Wis., manufacturers of notched-coil silver brazing and soldering rings and coined washers.

* * *

ROBERT C. BECHERER has been elected executive vice-president of Link-Belt Co. RICHARD E. WHINREY, assistant general manager at the Ewart plant, Indianapolis, has been appointed general manager.

* * *

DR. CHARLES H. MOORE, inventor and developer of Rutile gems, has been appointed head of the metal and ceramic division of P. R. Mallory & Co., Inc., Indianapolis.

* * *

ELMER E. HIGHTOWER has been appointed to the Detroit sales staff of the Lapeer Mfg. Co., manufacturer of toggle-action clamping devices.

* * *

JOHN F. SPAULDING has been appointed sales manager of the Black & Decker Mfg. Co., Towson, Md.

* * *

RAY SMITH has joined the sales staff of KSM Products, Inc., Merchantville, N. J., as junior engineer. Before coming to the stud welding business, he worked for a steel warehouse.

* * *

HOWARD G. RISTOW has been named head of the production control department of Americain Welding & Manufacturing Co., Warren, O.

L. K. STRINGHAM has been appointed chief engineer for The Lincoln Electric Co., Cleveland. He has been with Lincoln since 1933 and has worked continuously in the engineering department. On the board of directors, he is also a member of the NEMA - Navy committee on low-hydrogen electrodes, a member of AWS, a fellow in the AIEE and a member of Eta Kappa Nu.

* * *

WILLIAM V. SHAKESPEARE has been appointed sales manager of the Thor export sales division of Independent Pneumatic Tool Co. He joined Thor in 1936 after being an All-American football star for Notre Dame.

* * *

ORVILLE F. FIGLEY has been appointed assistant to the vice-president of sales of U. S. Steel Supply Co. KEITH P. RINDFLEISCH, who has been Pittsburgh district manager, will come to Chicago to take over Mr. Figley's former post of Chicago district manager. WESLEY N. GORDON will take over as Pittsburgh district manager. ARTHUR I. GIBSON is manager of the newly formed sheet and strip division of the general sales department. WALTER KILIMNIK has been appointed manager of the alloy division.

* * *

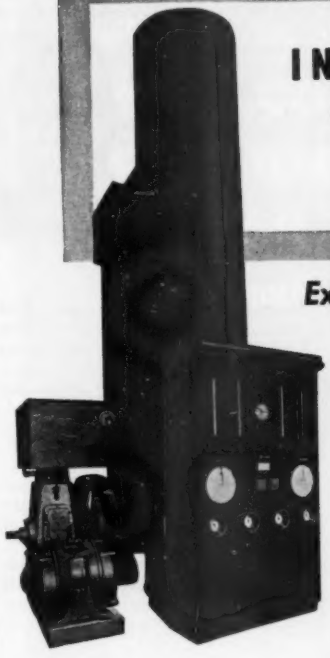
A. F. VINSON has been appointed assistant manager of the General Electric Company's manufacturing services division. His former posts with G-E include service as manager of the welding division at Fitchburg, Mass.

* * *

KENNETH G. HUBACH has been named manager of the newly created commercial weldment department of Baldwin-Lima-Hamilton Corp., Eddystone, Pa. In 1936 he joined Page Steel and Wire as a welding engineer and in 1942 became general manager of Standard Electrode and Mfg. Co., a large producer of aircraft welding electrode. Earlier this year he joined H. L. Yoh Co. as chief engineer on a special overseas job.

* * *

DR. HAROLD L. MAXWELL, supervisor of general consultants, E. I. Du Pont de Nemours & Co., Inc., has been elected a vice-president of the American Society for Testing Materials. Active in ASTM work for many years he is also a member of the AWS.



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PLANTS

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OXYGEN
AND
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Producing Plants

Built in standard sizes—15 meters or 530 cu. ft to 283 meters or 10,000 cu. ft.—in single and double rectification units. If you need them, larger sizes are available.

If the more than one quarter of a million INDEPENDENT CYLINDERS we have built were filled at one time, they would hold more than 50,000,000 cu. ft. of gas!

Furthermore, Independent Acetylene Cylinders hold from 5 to 10% more gas, and the uniformity of the monolithic filler insures even distribution of acetone. Oxygen Storage cylinders available in 12' and 20' lengths; capacities 850 and 1500 cu. ft.

10 C.F. 40 C.F. 60 C.F. 100 C.F. 150 C.F. 250 C.F. 300 C.F. 340 C.F.

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CYLINDERS AND GAS PRODUCING EQUIPMENT
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O'FALLON 5, ILLINOIS

HOBART 12 electrode (E-6012)

...for use in any position with *AC* or *DC* current

What ONE electrode can handle 80% of all your production work? What ONE electrode is today's best buy for all-purpose welding? The answer to both questions is the same—the Hobart "12". It's truly a premium electrode in both quality and performance—yet actually costs you less than any other E-6012 electrode because it gives you more actual weld deposit, increased production, less clean-up time.

YOU CAN STANDARDIZE on Hobart "12"—many of the country's largest fabricators of tanks, automobile frames, agricultural implements, etc., already have. They tell us that the Hobart "12" is the most versatile electrode they have ever used. They tell us, too, that the Hobart "12" goes further—leaves more actual weld deposit per electrode because there's less spatter and less stub loss, even when higher than normal welding currents are used.

You've tried the rest . . . now try the best. Write us today for complete electrode catalog and free samples of the Hobart "12" to try on your next job. You'll be glad you did.

HOBART BROTHERS COMPANY

Box U-1111, Troy, Ohio

"One of the world's largest builders of arc welders"

Simplify all your welding by using HOBART ELECTRODES

A. D. ENGLE has been named assistant vice-president for research of The Austin Co., Cleveland. As director of research from 1936 to 1942 he played a big role in design of welded structures. A registered professional engineer in 19 states, he is also a member of AWS, ASCE, and numerous other technical organizations.

* * *

RICHARD A. FLINN, assistant chief metallurgist in American Brake Shoe Company's research and development center, will accept an associate professorship of product engineering and metallurgical engineering at the University of Michigan.

* * *

THURSMAN HASKELL has been appointed special representative in the western area sales department of American Steel and Wire Co., a U. S. Steel subsidiary. He will make his headquarters at Chicago. Mr. Haskell was formerly sales manager at Denver.

* * *

PAUL L. WRIGHT has been appointed sales manager of the Buffalo, N. Y., plant of Joseph T. Ryerson & Son, Inc., steel distributor.

* * *

DR. CHARLES R. ESSICK has been named chairman of the board of Pennsylvania Optical Co. HENRY CHEATHAM, former vice-president and treasurer is now president. WILLIAM T. ECK, former vice-president and secretary is now vice-president treasurer. THADEUS J. GLEMBOCKI is secretary. All four men are directors.

* * *

Seven new posts in Worthington Pump and Machinery Corp. have been taken over by the following men: GEORGE P. PASSMORE is assistant to the vice-president in charge of manufacturing; A. M. TULLO, works manager of the company's Wellsville, N. Y., plant; JOHN BURLICK, assistant to the works manager at the Harrison plant; MAX A. HEYMAN, assistant to the works manager at the Harrison plant in charge of production control; W. D. SIZER, manager of regional engineering and service; GEORGE F. HABACH, executive engineer at the Harrison plant; EVERETT SCHMACHTENBERG, chief engineer of the centrifugal manufacturing division at the Harrison plant.

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General Purpose and Heavy Duty Cam-Lok Cable Connectors and Terminal Lugs are completely interchangeable. You can couple and uncouple all cables and whip ends from No. 2 through 4/0 *without* adapters, quick as a wink. No other connector gives such complete versatility with trouble-free service.

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DIVISION OF EMPIRE PRODUCTS INC.

P.O. Box 98-B, Cincinnati 36, Ohio

30 YEARS AGO

(From THE WELDING ENGINEER of Nov., 1921)

ARC welding on the side of a Central American mountain has repaired a 22-in. pipeline, reports Westinghouse Elcetric & Mfg. Co. The 3,000 ft pipeline runs down the mountain from San Jacinto, Honduras, and was corroded paper-thin in places. New plates were shaped to size after the corroded areas had been removed. Arc welded joints between the new and old piping held under double the working pressure. Pulling the motor-driven arc welder up the mountain took 4 mules and 9 peons.

— 30 YEARS AGO —

CHINA has its welding magazine, too. Published on Yuen Ming Yuen Road, Shanghai, it is the company bulletin of the China Oxyacetylene Welding Works. Bulletin No. 5 was an eight-page sheet and had photos of 21 welding jobs.

— 30 YEARS AGO —

HOBBIE'S Welding Plant, Hampton, Ia., has built a 4,600 lb towing truck for bringing in stalled or damaged autos from the surrounding territory. It carries in cars by hoisting the front wheels up on a powerful derrick on the back of the truck. The truck has a Willys-Knight 88-4 motor with Republic cord tires. It will go 40 miles an hour when unloaded.

— 30 YEARS AGO —

OFFICIALS of the Rock Island Lines can be proud of the manner in which their welding repair procedures have been organized. Mr. E. Wanamaker's paper in the proceedings of the American Welding Society shows that the welding department is in good hands and will do a good job.

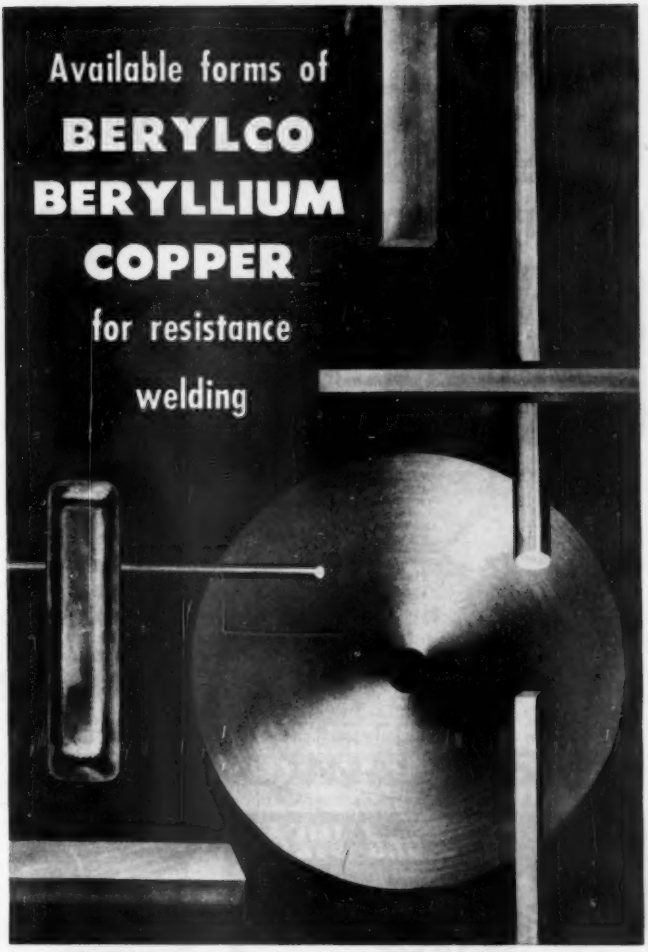
— 30 YEARS AGO —

INDIANA Oxygen Company's novel exhibit at the Indianapolis Industrial Exposition included a lifelike wax figure of a weldor bending over a firebrick preheating furnace and welding a broken casting.

— 30 YEARS AGO —

THERMIT welding repaired a helical 2½-in. pipe coil for the American Chicle Company in Long Island City, N. Y. The coil had to be cut in half for transportation since it was 17 ft in diameter. This made 9 cuts by oxyacetylene torch necessary. All nine joints were made by Thermit welding procedures after the coil was installed in the chicle factory.

— 30 YEARS AGO —



You can buy Berylco in casting ingots. You can buy it as rod and bar, in rounds, rectangles, hexagons or squares. You can buy it as standard size seam welding wheels.

However you buy it, Berylco is an ideal resistance welding material, gives you properties not otherwise obtainable. To find out what Berylco can do for you, take advantage of the technical knowledge of the world's largest producer of beryllium copper. Blueprint your problem.

The Beryllium Copper TECHNICAL BULLETIN, issued monthly, is full of helpful information about and uses. To receive your copy regularly, write on your business letterhead.

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Name of Nearest Distributor Upon Request

STULZ-SICKLES CO. SOLE PRODUCERS
92 N. J. Railroad Ave.
Newark 5, New Jersey

NEW PRODUCTS

(Continued from page 63)

Special New Guns Speed Hand Metallizing

Two new metallizing guns, Type 4E and Type 5E, are said to develop the highest spraying speeds yet for hand-held operation. They also are nearly automatic since they have a "jet siphon" principle in the gas head that automatically compensates for variations as high as 10 psi in gas pressure.

Specially designed for spraying corrosion-resistant metals such as zinc and aluminum, Type 5E sprays 3/16-in. wire and deposits as much as 55 lb of zinc or 15 lb of aluminum per hour. It can be mounted for use on a lathe or other machine in production work.

The type 4E will spray all types of wire, carbon steels, stainless, Monel, bronze, in diameters from 20 B&S gage to ⅛-in. Its speed of deposit is claimed to be as much as 40% higher than previous models. It can also be lathe-mounted. Both guns weigh 4 lb 12 oz.

Metallizing Engineering Co., Inc., 3814 30th St., Long Island City 1, N. Y.

• • •

New Light Insulation Holds Off 1,800 F Heat

A fibrous silica insulation originally developed for jet airplanes shows promise in thermal and electrical insulation problems in petroleum, chemical and electronics fields. Called "Refrasil," it is light, not bulky, unusually flexible and protects against heats up to 1,800 F. Some applications have been: high temperature thermal insulation; electric space separators; filtration of corrosive or high temperature materials.

The H. I. Thompson Co., 1733 Cordova St., Los Angeles 7.

Eight Welds a Minute With New Stud Welder

NEW stationary stud welder with two heads is claimed to operate at the high speed of eight welds per minute. Accurate placement of the work in a V-type holder is insured by a built-in microswitch that stops the welding sequence if the work isn't aligned properly.

The operator loads suspension buttons and arc shields into each of the two welding heads after the work has been spotted. By pressing two start buttons in the front of the welder, the welding sequence is commenced and completed automatically.

An automatic spark shield rises up in front of the welding heads to protect the operator from possible flash or spatter.

KSM PRODUCTS, INC., Merchantville, N. J.

* * *

"Workabinets" Announced for X-Ray Dark Rooms

A COMBINATION of work bench, storage compartment and shelf space is provided by a new unit known as a "Workabinet" that is especially designed for work in the X-Ray dark room. Available in 5, 6, 7 and 8 cu ft models, the new cabinets are made of sanded hardwood with a coat of sealer or clear shellac. The loading bench area is covered with formica or equivalent. The two larger models incorporate a wastepaper bin. The service cabinet space is handy for cassettes, films, chemicals, opaques and various other accessories.

The three main sections of the "Workabinet"—loading bench, service cabinet and center supporting section—are available separately.

X-RAY DEPT., GENERAL ELECTRIC Co., 4855 Electric Ave., Milwaukee 14.

YOU CAN TEAM UP
A GB SILVER BRAZING
ALLOY AND FLUX
TO GET
PERFECT RESULTS!
NO MATTER HOW YOU HEAT...
The method of heating for low temperature brazing is a decided factor in the selection of the right silver solder and flux. Specify GB and you're right, because you'll get a combination that was made to work right!
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OXY-PROPANE
OXY-CITY GAS
CARBON TONGS
RESISTANCE
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CHARCOAL
BLOW PIPE
GB's line of six standard silver solders offers a range which meets standard production methods. When special solders are required, GB's Technical Service Division offers assistance which is based on experience in alloying and refining precious metals that goes back more than 80 years.
GB Standard Silver Solders
GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F
GB FLUXES
GB
The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.
GB DATA BOOK
Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.
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THE SIGHT FEED GENERATOR COMPANY

West Alexandria, Ohio, U.S.A.

"Manufacturers of Welding Equipment for More Than 25 Years"

Small Bending Machine Forms Sheet, Tube, Rods

BENDS, partial bends and complete folds can be made with the new model "Bendit" metal-forming machine. It was developed for short-run production work such as the forming of aircraft components. Radii can be formed through a range of 1/32 to 5/8 in.; boxes made up to 15 by 15 by 5 in. No expensive dies or intricate tooling are required. Interchangeable bending blades of soft steel are supplied, to be cut or sawed to size to meet job requirements. Actual bending is done by a hardened and ground steel roller.

KILHAM ENGINEERING, INC., Plainville, Mass.

* * *

Special Cabinet Keeps Low-Hydrogen Coatings Dry

To insure that low-hydrogen type coatings on electrodes will remain dry after being removed from their original containers, you can now store them in a "Low-Hydrogen" electrode stabilizer. The cabinet contains a heating element that keeps the moisture content in the coatings below the critical point. As much as 400 lb. of electrodes can be stored in the stabilizer, which can be positioned anywhere near the welding station.

FRED C. ARCHER, INC., 606 West Wisconsin Ave., Milwaukee 3.

"Red Head"

WELDING CLAMPS

Designed for Welding

Made to take abuse

1. Case Hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate and heat treated to give greater resistance to bending and twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

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Stop LOSING MONEY!

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SLIP-ON SOLDERING TIP

★ ELIMINATES TANK OXYGEN

★ ELIMINATES BUCKLING • WARPING

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★ FITS ANY WELDING TORCH

The Anzick Slip-On Soldering Tip assures perfect soldering in half the usual time. Profitable soldering at half the usual cost. Used in Body Shops everywhere. Write for Literature!

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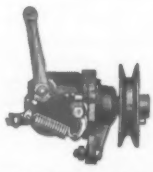

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New Plotting Paper Will Aid Engineers

"ARKTAN" or arc-tangent coördinate graph paper is introduced to permit the plotting of uninterrupted curves having the form:

$F(x) \rightarrow \pm \infty$

The use of arc-tangent coördinates thus permits the plotting of data having values from plus infinity to minus infinity and including zero as well. Most asymptotic functions become approximately linear in this coördinate system and thus can be easily compared or extrapolated. Plotting of reactance functions, radioactive decay curves, heating and cooling curves are typical examples of applications for which extrapolation and interpolation are easily accomplished.

"Arktan" paper is available in two forms. Form 1235 has one arc-tangent scale and one linear scale; form 1236 has double arc-tangent coördinates. Form 1235 is used when one variable approaches a finite limit asymptotically as the other variable approaches infinity. Form 1236 is used when both variables approach infinity as a limit.

ORBIT ELECTRIC CO., 2710 N. Menard Ave., Chicago 39.

* * *

Hand-Operated Valves Show Long Life

NEW features that give long life to Hanna "Unitite" hand-operated valves include a chromeplated stem for minimum wear, a Neoprene stem collar to prevent abrasion from dust; a standard grease fitting at top of stem and an aluminum-bronze disk. Valve handle movement is limited by internal stops to allow a 360-deg option of handle placement. Such valves are used in the welding industry for many applications including hydraulic or air operated jigs and holding fixtures, positioning equipment and accessory operations.

HANNA ENGINEERING WORKS, 1765 Elston Avenue, Chicago 22.

* * *

Makes Rectifiers in 50-kw Size

EXTRA-LARGE selenium cells (made by a new vacuum process) are said to make it possible to manufacture rectified units of 50 kw and over. At present this manufacturing is being done on a custom basis. The large cells are said to permit the use of fewer parallel elements for a given d-c output and also keep weight down.

SYNTRON CO., 815 Lexington Ave., Homer City, Pa.

Meco SAF-T-CHEK REGULATOR

LASTS . . . 4 Times longer

MULTI-SEAT QUADRUPLES LIFE

Four times the life of ordinary regulators is guaranteed by exclusive four-seat construction. Each seat may be used successively – adjusted simply. No special tools or mechanical skill is required to maintain *any* part of the MECO regulator.

SAF-T-CHEK VALVES

This exclusive MECO construction provides insurance against seat or diaphragm failure. Built-in, self-actuating SAF-T-CHEK valves prevent damage to equipment from careless handling.

BOLTED DIAPHRAGM NEVER PUCKERS

Absolutely uniform pressure and flexibility is secured by *bolting* special alloy diaphragm – instead of conventional screw fastening which puckers diaphragm fibres. Diaphragm should last the life of the regulator.

Close yoke between diaphragm and multi-seat block insures transmission and correction of tiniest pressure variations providing constant and uniform pressure.

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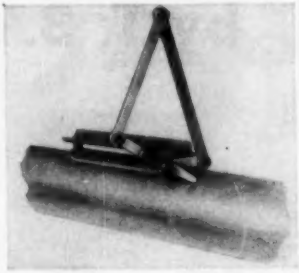
SAVE TIME and MONEY

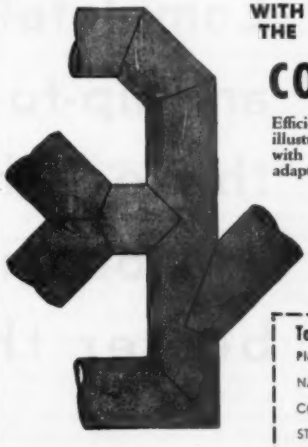
NEW EASE AND SPEED

ON PIPE AND STRUCTURAL STEEL LAYOUT JOBS



WITH THE

CONTOUR MARKER



Efficient, accurate, easy to use. Any of the angles illustrated can be marked off in 5 minutes or less with assured accuracy. Both models complete with adapter for square or rectangular shapes.

STANDARD MODEL

Fits into hip pocket. For use on pipe 1½ to 18 inches.

JUMBO MODEL

For 16 to 48 inch pipe. Includes belt to fasten on pipe.

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WELDING COMPOUNDS

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Choose the One Best Suited to Your Job . . .

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W-AL-CO RODS

for Welding of ALUMINUM

ELECTRIC AND GAS WELDING

Drawn Wire

TYPES 2S, 43 and 52

Brazing 716

FOR CAST ALUMINUM

Use Extruded Rods

Types 142, 195, 355 and 356

for Better Welding

3/16" size only

Aluminum Solder

White Metal

Welding Alloys Manufacturing Co.

744 Broad St. Newark 2, N. J.

From the Patent Office

Regulable Solder Supply

2,565,909. HOLLEY CARTMILL, San Bernardino, Calif. Filed Oct. 6, 1949. Granted Aug. 28, 1951.

A newly patented electric soldering iron includes a substantially cylindrical body portion provided at one end with a bit and at the other with a chamber to act as a reservoir. A separate wall is spaced from the outer walls of the body within the part surrounding the chamber. An electric heating coil is arranged between the spaced walls of the chamber and of the body portion. A removable apertured cover plate goes over the open end of the above mentioned chamber. A channel leads from the chamber to the bit. A shank member has spaced cylindrical sections and a half cylindrical section. The body part is one of the cylindrical sections. Means on the half cylindrical portion of the shank removably hold the cover plate on the body. The means include a pressure screw applied against the cover plate. A valve within the chamber controls the inlet opening of the chamber channel. A lifting frame structure carries the valve within the chamber. A spring-pressed lifting rod projects outward from the chamber and has an axially movable central section connected with the frame structure. It also extends through the chamber, through the apertured cover plate and through part of the half cylindrical section of the shank. It continues through an eccentric section carrying a finger piece arranged alongside of and movable along the handle for imparting an axial movement to the central lifting rod section.

* * *

Tweco Trademarks Registered

THE United States Patent Office has issued official registration notices on six trademarks used by Tweco Products Co., Wichita 1, Kan. They are "Twecotong" for electrode holders, "Tweco" for electric welding equipment (including holders, ground clamps, cable connectors, cable splicers, cable terminals, etc.), "Super-Mel" for insulation on electrode holders, "Sol-Con" and "Mec-Con" for electrical cable connectors and cable-terminal connectors, and "Hol-Grip" for electrode holders and parts.

SPATTER *Doesn't* MATTER...

ON A HARGRAVE WELDERS' CLAMP

NO. 41 LIGHT SERVICE

NO. 45 DEEP REACH

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SPRING CLAMP

For spot welding and other light duty welding. Holds firmly, releases instantly. Useful where speed is needed. Every shop needs a few.

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Hargrave Nos. 41, 43 and 45 Welder's Clamps resist spatter permanently because the Patented screws are made of an anti-spatter, solid alloy material—not to be confused with ordinary plated types of screws. They speed your work . . . ease the job and give years of trouble-free service. Frames are forged steel, heat-treated and designed to give greatest strength for weight. Oscillating (ball and socket) tip is put on to stay. Each clamp is Individually Tested. Openings in all popular sizes.

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There is an Industrial Distributor Stock near you.

HARGRAVE

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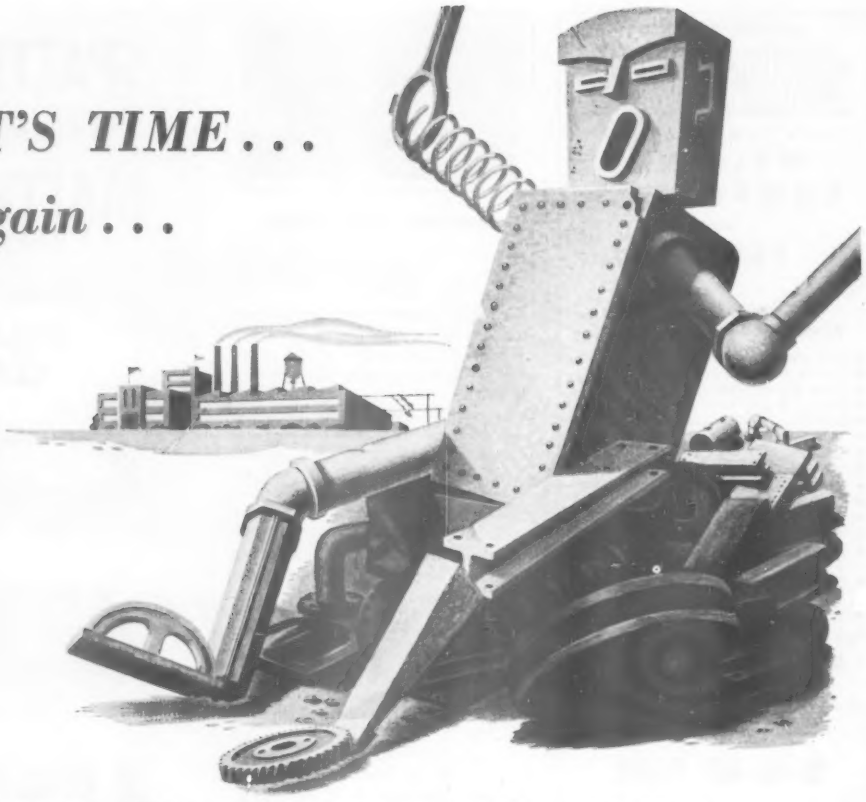
The Cincinnati Tool Co.

IT'S TIME . . .

again . . .



TO WAKE UP SCRAPPY!

Scrap's getting scarce again . . . compared to the amounts we need . . . and it's up to *all* of us to *help* produce enough steel.

107,000,000 tons of steel is the present rate of production in 1951 . . . 119,500,000 tons is expected in 1952.

Last year, 1950, we produced 97,800,000 tons.

All that extra steel—enough to take care of *both* military and civilian needs—calls for *more scrap iron and steel.*

Scrap Inventories Are Alarmingly Low

While steel mills are producing at a greater rate than ever, scrap inventories have dwindled. Many mills are operating on a hand-to-mouth basis with shut-downs threatened unless we furnish more scrap.

We *do* have the scrap. It's everywhere, not just in the form of *production* scrap—the "leavings" of machining, normally turned over to scrap dealers . . . but also in the form of *idle* metal: obsolete machines and tools, no-longer-usable jigs and fixtures, gears, chains, pulleys, valves, pipe, abandoned steel structures, etc.

We must have this *idle* metal to keep the furnaces running.

Please cooperate. Set up a Scrap Salvage Program in your plant—*now*. For a complete plan on "how to do it", write for booklet "Top Management: Your Program for Emergency Scrap Recovery". Address Advertising Council, 25 W. 45 Street, New York 19, N. Y.

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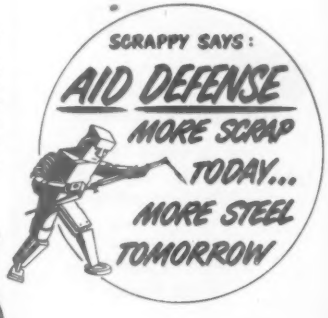

NON-FERROUS SCRAP IS NEEDED, TOO!

This advertisement is a contribution, in the national interest, by

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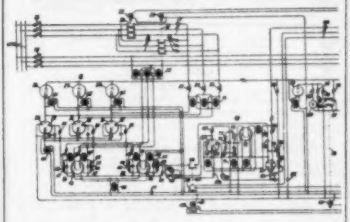
Spot Welding System

2,568,464. GEORGE L. ROGERS, Schenectady, N. Y. Assigned to General Electric Co., Schenectady. Filed July 31, 1941. Granted Sept. 18, 1951.

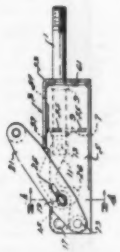


Delayed patent registration was recently granted to a spot welding circuit that includes a supply, a load, a capacitance, means for charging the capacitance and means responsive to the voltage of the capacitance for preventing charging when voltage is high enough. There are also means for discharging the capacitance to effect energization of the load circuit. There are means responsive to the discharge current of the capacitance for controlling the charging means to recharge the capacitance.

* * *

Toggle Clamp

2,567,436. FRIEDRICH W. LAMPE, Detroit. Assigned to Lapeer Mfg. Co., Detroit. Filed March 29, 1949. Granted Sept. 11, 1951.



Newly patented toggle clamp has a member that moves back and forth, a guide link with a fixed pivot and a bow link with a second pivot connection. A third pivot connection is on the bow link between it and the guide link. The bow-link has a concave side facing the plane defined by the axes of the first and second connections. A lever has a fourth pivot and is operatively secured to the third pivot for reciprocating the member into locked positions at opposite ends of its stroke with less than 180 deg movement of the lever.

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FOR WELDING AND POWER CABLES

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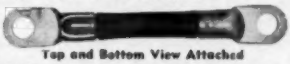
An eight-saddle back-up block and a special round-end punch for mechanically attaching Copper TWECOLUGS and "Lug-Set" Splicers. The punch impacts the lug barrel for a quick connection with maximum strength and conductivity. All you need is a hammer.



Top and Bottom View Attached

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This helmet is of one-piece molded fibre construction. No rivets used. It has a formed top to protect the top of the head, has ample room inside, is perfectly balanced, weighs only 16 ounces and is extremely comfortable. Can be furnished with any of our three headgears and with either the standard or special lift front changing lens retainer.

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Prevents adhesion of welding spatter on multipass welds or on single pass welds where heat is intense.

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Flash-Ex, a creamy white liquid is easily applied by any convenient means to parts that must be protected. Its use prevents imperfect welds by eliminating the possibility of spatter "shooting across" the jaws as when build-ups occur. The coating is very durable and permits many more welds between applications than ordinarily.

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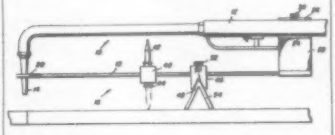
Detroit 17, Mich.

Cutting Torch Attachment

2,569,304. MELVIN C. GLEDHILL, Las Cruces, New Mex. Filed Feb. 3, 1950. Granted Sept. 25, 1951.



A newly patented attachment for a flame cutting torch includes a rod that can be attached to the torch tip. At the other end of the rod is a device for rigidly attaching it to the torch handle and parallel with it. A guide is slidably and rotatably mounted on the rod. The guide is selectively rotatable on the rod into an inoperative position. Means on the guide selectively secure the guide in an operative position. The guide comprises a guide block with a transverse V-shaped groove in it. The apex of the groove is semi-circular in shape. The guide block is adapted to slidably engage a substantially V-shaped guide bar to guide the tip of the torch in cutting straight lines.

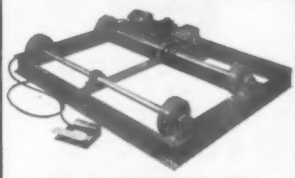
* * *

Grinding, Feather-Edging Tool

2,567,782. CARM P. RHEES, Staten Island, N. Y. Filed Sept. 19, 1949. Granted Sept. 11, 1951.

A recently patented feather-edging, grinding and polishing tool has a disc holder and a disc removably mounted on it. The disc holder has an enlarged circular end portion and a reduced neck behind that which carries the disc. The reduced neck is circular in cross-section. The reduced neck provides a yielding frictional drive between the disc holder and the disc. A circular flange is behind the neck. A compression spring is provided between the flange and the disc to press the disc against the enlarged end.

REED ENGINEERING COMPANY
1007 W. Fairview Carthage, Mo.



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Reversible foot switch extra.

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Of Welding Engineer, published monthly, except in June, two issues in June, at Chicago, Illinois, for October 1, 1951.

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[SEAL] ELVA G. MASLIN.
(My commission expires March 30, 1952)

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3,500	1/8"	McKay	19-9
4,500	1/8"	Arcos	25-20
31,250	1/8"	Alloyrod	19-9
4,600	5/32"	Page	18-8
9,550	5/32"	Arcos	19-9
15,350	5/32"	McKay	19-9
2,050	5/32"	Arcos	25-20
4,900	5/32"	Murex	25-20
2,800	5/32"	Raco	25-20
3,000	5/32"	McKay	19-9
14,000	5/32"	Murex	25-20
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A

Acetogen Fabricators, Inc. 9
Air Reduction Sales Co. 18
Allen Co., L. B. 99
Alloy Rods Company 75
American Brass Company 27
American Chain & Cable Co., Inc. .. 71
American Ind. Safety Equip. Co. .. 74
American Manganese Steel Div. 19
American Optical Company 28
Ampco Metal, Inc. 76, 84
Anti-Borax Compound Co. 95
Anzick Mfg. Co. 92

B

Banner Mfg. Company 15
Bastian-Blessing Co., The 81
Belden Mfg. Company ..... Inside Front Cover
Beryllium Corp., The 89
Bonney Forge & Tool Works 21
Bridgeport Brass Co. 73
Burdett Oxygen Co., The ..... Inside Back Cover

C

Cam-Lok Division of Empire Products, Inc. 88
Chicago Boiler Company 92
Chicago Eye Shield Co. 2
Chicago Hardware Foundry Co., The 90
Cincinnati Tool Company 95
Contour Marker Corp. 93

E

Eastman Kodak Company 69
Eutectic Welding Alloys Co. 83

G

General Electric Company 20
General Electric Co., X-Ray Dept. 26
Goldsmith Bros. Smelting & Refining Co. 91

H

Hammer Blow Tool Company 97
Hanna Engineering Works 11
Harnischfeger Corp. 8, 64
Harris Calorific Company, The ... 14
Hobart Bros. Co. 1, 88

I

Independent Eng. Co., Inc. 87
International Nickel Co., Inc. 10

J

Jackson Products 4

K

K-G Equipment Co. (Inc.), The .. 16

L

Lincoln Electric Co., The 30
Linde Air Products Co., A Div. of Union Carbide & Carbon Corp. . 77

M

Mallory & Co., Inc., P. R. 22
Metal Bond Mfg. Co. 97
Metal & Thermit Corp. 61
Modern Eng. Co., Inc. 93

N

National Carbide Corp. 86
National Welding Equipment Co. .. 7

P

Page Steel & Wire Division 71
Pandjiris Weldment Co., The 82
Pennsylvania Optical Company ... 23
Pierce Governor Co., Inc., The 92

R

Rankin Mfg. Co. 80
Reed Engineering Co. 98
Roden Co., Philip 25
Ruemelin Mfg. Co. 78

S

Sellstrom Mfg. Co. 98
Sight Feed Generator Co. 92
Smith Corp., A. O. ..... Back Cover
Solar Aircraft Co. 12-13
Steel Sales Corp. 74
Stoody Company 29
Stulz-Sickles Co. 90

T

Tempil Corp. 84
Thermacote Company 76
Tillman Co., John 97
Tipaloy, Inc. 86
Titanium Alloy Mfg. Co. 24
Tube Turns, Inc. ..... Binds between pages 32-33
Tweco Products Co. 97

U

Union Carbide & Carbon Corp., Linde Air Products Co. 16
United States Steel Corp. 78
United States Steel Supply 78
United Wire & Supply Corp. 85

V

Victor Equipment Co. 66
Vogel Tool & Die Corp. 80

W

Wagner Mfg. Co. 79
Watchemoket Optical Company ... 82
Wayne Chemical Products Co. 98
Welding Alloys Mfg. Co. 95
Welding Fittings Corp. 17
Weldit, Inc. 57
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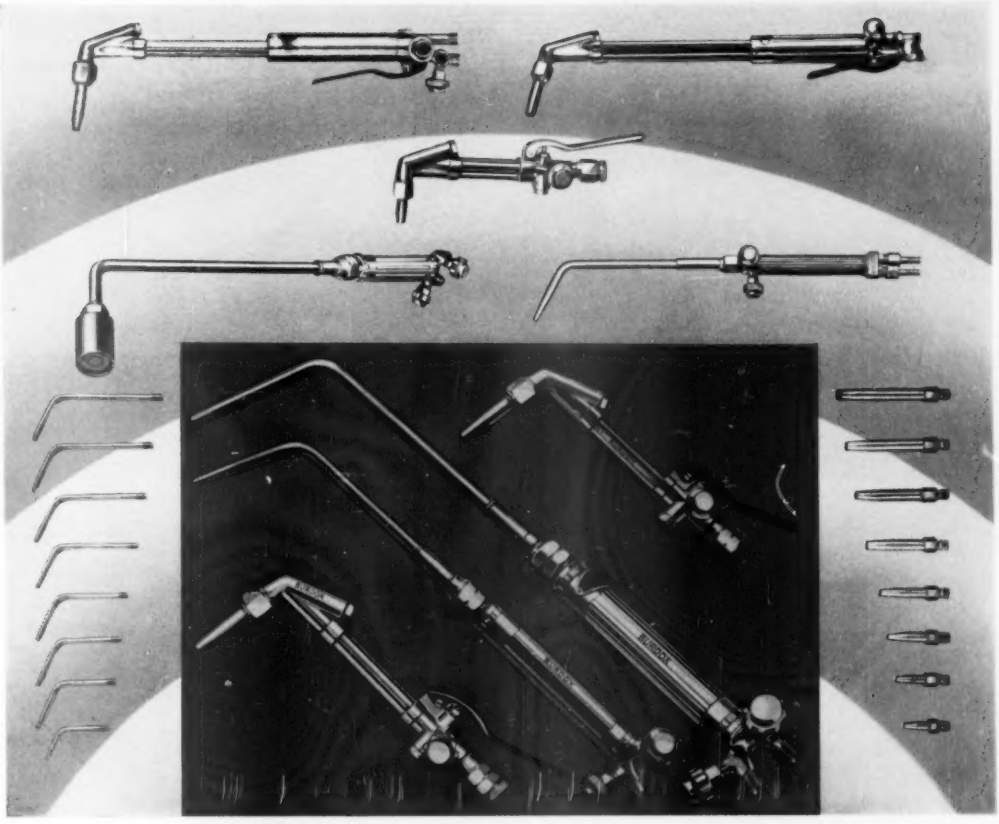

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